

# BMJ Open

BMJ Open is committed to open peer review. As part of this commitment we make the peer review history of every article we publish publicly available.

When an article is published we post the peer reviewers' comments and the authors' responses online. We also post the versions of the paper that were used during peer review. These are the versions that the peer review comments apply to.

The versions of the paper that follow are the versions that were submitted during the peer review process. They are not the versions of record or the final published versions. They should not be cited or distributed as the published version of this manuscript.

BMJ Open is an open access journal and the full, final, typeset and author-corrected version of record of the manuscript is available on our site with no access controls, subscription charges or pay-per-view fees (<http://bmjopen.bmj.com>).

If you have any questions on BMJ Open's open peer review process please email [editorial.bmjopen@bmj.com](mailto:editorial.bmjopen@bmj.com)

# BMJ Open

## Variations in outcomes by residential location for women with breast cancer: a systematic review

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2017-019050
Article Type:	Research
Date Submitted by the Author:	08-Aug-2017
Complete List of Authors:	Dasgupta, Paramita; Cancer Council Queensland, Cancer Research Centre Baade, Peter; Cancer Council Queensland, Cancer Research Centre Youlden, Danny; Cancer Council Queensland, Cancer Research Centre Garvey, Gail; Menzies School of Health Research, Epidemiology and Health Systems Aitken, Joanne; Cancer Council Queensland, Cancer Research Centre Wallington, Isabella; Cancer Australia Chynoweth, Jennifer; Cancer Australia Zorbas, Helen; Cancer Australia Youl, Philippa; Cancer Council Queensland, Cancer Research Centre
<b>Primary Subject Heading</b>:	Epidemiology
Secondary Subject Heading:	Oncology
Keywords:	Breast tumours < ONCOLOGY, EPIDEMIOLOGY, PUBLIC HEALTH

SCHOLARONE™  
Manuscripts

**Variations in outcomes by residential location for women with breast cancer: a systematic review**

Paramita Dasgupta<sup>1</sup>, Peter D Baade<sup>1,2,3, §</sup>, Danny Youlden<sup>1</sup>, Gail Garvey<sup>4</sup>, Joanne F Aitken<sup>1,5,6</sup>, Isabella Wallington<sup>7</sup>, Jennifer Chynoweth<sup>7</sup>, Helen Zorbas<sup>7</sup>, Philippa H Youl<sup>1,2,5</sup>

<sup>1</sup>Cancer Research Centre, Cancer Council Queensland, Brisbane, Australia

<sup>2</sup>Menzies Health Institute Queensland, Griffith University, Gold Coast Campus, Parklands Drive, Southport QLD 4222, Australia

<sup>3</sup>School of Mathematical Sciences, Queensland University of Technology, Gardens Point, Brisbane QLD 4000, Australia

<sup>4</sup>Menzies School of Health Research, Brisbane Queensland, Australia

<sup>5</sup>School of Public Health and Social Work, Queensland University of Technology, Herston Road, Kelvin Grove QLD 4059, Australia

<sup>6</sup>Institute for Resilient Regions, University of Southern Queensland, Toowoomba, Australia

<sup>7</sup>Cancer Australia, Sydney, New South Wales, Australia

§ Corresponding Author: Prof Peter D Baade, Senior Research Fellow  
Cancer Council Queensland, PO Box 201, Spring Hill QLD 4001 Australia  
Email: peterbaade@cancerqld.org.au  
Fax: +61 7 3259 8527; Phone: +61 7 3634 5317

Authors Email addresses:  
PY: philippa.youl@qut.edu.au  
PD: paramitadasgupta@cancerqld.org.au  
PB: peterbaade@cancerqld.org.au  
DY: dannyoulden@cancerqld.org.au  
GG: gail.garvey@menzies.edu.au  
JA: joanneaitken@cancerqld.org.au  
IW: Isabella.Wallington@canceraustralia.gov.au  
JC: Jennifer.Chynoweth@canceraustralia.gov.au  
HZ: Helen.Zorbas@canceraustralia.gov.au

Word length:  
Manuscript word count (excluding title page, abstract, references, figure legends, and tables): 4640  
Abstract word count: 287  
References: 104  
Tables: 6  
Figures: 1  
Supplementary files: 3

## Abstract

**Objectives:** To systematically assess the evidence for variations in outcomes at each step along the breast cancer continuum of care for Australian women by residential location.

**Design:** Systematic review

**Methods:** Systematic searches of peer-reviewed articles in English published from 1/1/1990 to 1/3/2015 using PubMed, EMBASE, CINAHL and Informit databases. Inclusion criteria were: population was adult female breast cancer patients; Australian setting; outcome measure was survival, patient or tumour characteristics, screening rates or frequencies, clinical management, patterns of initial care or post-treatment follow-up with analysis by residential location, or studies involving non-metropolitan women only. Included studies were critically appraised using a modified Newcastle-Ottawa Scale.

**Results:** Fifty-two quantitative studies met the inclusion criteria. Around 60% were considered high quality, 35% moderate and 5% low. No eligible studies examining treatment choices or post-treatment follow-up were identified. Non-metropolitan women consistently had poorer survival, with most of this differential being attributed to more advanced disease at diagnosis, treatment-related factors and socioeconomic disadvantage. Compared to metropolitan women, non-metropolitan women were more likely to live in disadvantaged areas and had differing clinical management and patterns of care. However, findings regarding geographical variations in tumour characteristics or diagnostic outcomes were inconsistent.

**Conclusions:** A general pattern of poorer survival and variations in clinical management for Australian female breast cancer patients from non-metropolitan areas was evident. However, the wide variability in data sources, measures, study quality, time periods and geographical classification made direct comparisons across studies challenging. The review highlighted the need to promote standardization of geographical classifications and increased comparability of data systems. It also identified key gaps in the existing literature including a lack of studies on advanced breast cancer, geographical variations in treatment choices from the perspective of patients and post-treatment follow-up.

**Keywords:** Breast cancer; Non-metropolitan; Systematic review; Geographical variations; Continuum of care

**Strengths and Limitations:**

Strengths:

- First systematic review examining evidence for geographical variations in breast cancer outcomes across the continuum of care for Australian women
- Review was conducted according to published guidelines
- All included articles were subject to quality assessment

Limitations:

- Wide heterogeneity across studies in study quality, levels of evidence, methodology, data sources, time period and terminology
- No meta-analysis was possible

## Introduction

Worldwide, breast cancer is the most frequently diagnosed cancer among females, accounting for 25% of all new diagnoses in 2012 and is the leading cause of female cancer mortality (15% of total cancer deaths).<sup>1</sup> Among Australian women, breast cancer is also the most common cancer and the second leading cause of cancer mortality.<sup>2</sup> Like other developed countries, Australia has high breast cancer incidence rates but relatively low mortality rates<sup>1</sup> with significant and ongoing improvements in survival, most likely due to earlier detection, screening mammography and improved treatments.<sup>3</sup> However not all women have benefitted equally from these improvements with international studies consistently reporting geographical variations in survival<sup>4-6</sup> and across the breast cancer continuum of care (such as screening, diagnosis, treatment, post-treatment and psychosocial care).<sup>7-9</sup> While Australia has relatively high survival rates compared to international benchmarks,<sup>10</sup> significant variations exist with poorer survival for rural and disadvantaged women.<sup>11-13</sup>

Australia has a universal health-care system, however it is also a country of vast distances with cancer-related services typically being concentrated in major cities<sup>14</sup> so that those living elsewhere often face long travel times and limited access to specialized care.<sup>11 15</sup> Although about 20% of the total Australian population live outside a major city, for some states and territories this percentage increases to over a third.<sup>16</sup> There is also considerable overlap between remoteness and socioeconomic status with 34% of residents in major cities considered affluent compared to only 2% of those from very remote areas.<sup>17</sup> Current strategies to better address the needs of rural cancer patients and to make cancer care more accessible include the Australian Government's establishment of cancer centres and radiation facilities in regional Australia, exploring innovative models of care and other local-level initiatives.<sup>15 18</sup>

A comprehensive understanding of the drivers of variations in outcomes across population groups is a prerequisite for ensuring equitable cancer care and improving outcomes for all Australians. This systematic review aimed to identify, assess and synthesize the current evidence relating to geographical variations in survival, patient and tumor characteristics, diagnostic and clinical outcomes for female Australian breast cancer patients. It was conducted as part of a larger systematic review that also investigated psycho-social outcomes<sup>19</sup> and variations by Indigenous status. Such a review may help identify gaps in knowledge, formulate strategic research priorities and develop evidence-based interventions to reduce the observed inequities.

## Methods

### Terminology

Due to the range of definitions used to define geographical areas, geographical remoteness was categorised into “metropolitan” areas (typically “major cities” or “urban”) and “non-metropolitan” areas (comprising the remaining localities). However, where relevant, important patterns observed within the remoteness categories were described in greater detail such as studies relating specifically to remote or very remote areas.

**Clinical Questions**

The published PRISMA guidelines for conducting systematic reviews<sup>20</sup> were followed for this review. As a first step, a series of clinical questions to guide the review were clearly defined and agreed upon before commencing the review process in consultation with a Project Steering Group that included clinicians, researchers, allied health practitioners, consumer advocates with experience in breast cancer and health policy representatives. All questions conformed to PICO guidelines<sup>20</sup> in which the target population (P), intervention/exposure (I), comparator (C) and outcomes (O) are clearly defined and used to guide the review process, with the comparator being the only optional component.<sup>21</sup>

Eleven clinical questions examining variations between non-metropolitan and metropolitan women with breast cancer (collectively referred to as ‘residential location’) were grouped according to 1) survival (one question); 2) patient/tumour characteristics (two questions); and 3) diagnostic and treatment outcomes (eight questions) (Table 1).

**Literature searches**

The electronic databases: PubMed, EMBASE, CINAHL and Informit were systematically searched for all indexed articles from 1 January 1990 to 1<sup>st</sup> March 2015. Final searches were undertaken from 2<sup>nd</sup> to 6<sup>th</sup> March 2015. The Web of Science database was used for cited reference searches.

Search strategies were based on keywords and subject headings to reflect the review aim with separate queries designed for each clinical question (see supplementary appendix 1). Key terms of ‘breast neoplasms’, ‘female’ and ‘Australia’ were combined with terms relating to geographical aspects including ‘rural health’, ‘geographic inequalities’, ‘spatial’, ‘health services accessibility’ and ‘remoteness’ and outcome measures of interest notably ‘survival’, ‘stage’, ‘diagnosis age’, ‘socioeconomic’, ‘mammography’, ‘screening rate’, ‘re-screening’, ‘clinical management’, ‘patterns of care’, ‘mastectomy’, ‘breast reconstruction’, ‘chemotherapy’, ‘radiotherapy’, ‘lymph node’ and ‘guideline adherence’. Additional synonyms reflecting each of the key terms were also included.

**Inclusion criteria**

Studies were eligible if they met the following inclusion criteria:

- 1) the population included adult female breast cancer patients or focussed on a breast cancer specific sub-group; and
- 2) had an Australian setting; and
- 3) the outcome measure was survival, patient or tumour characteristics, screening participation or frequency, clinical management, patterns of initial care or post-treatment follow-up; and
- 4) was
  - a) a quantitative study on non-metropolitan versus metropolitan comparisons; or
  - b) a qualitative study on geographical inequalities; or
  - c) quantitative or qualitative studies reporting on relevant outcomes for non-metropolitan women only.

The scope of the review was limited to English language peer-reviewed original research articles. Reviews, editorials, books, conference abstracts and commentaries were excluded, although when identified through the systematic searches their reference lists were examined for relevant articles.

### Review process

After removing duplicates, the titles and abstracts of all articles identified during the searches were independently reviewed by two authors (first PD, second PY, DY or PB) for possible inclusion based on their relevance to each clinical question. Discrepancies were clarified through discussion between the two reviewers and if necessary the other reviewers were consulted. Full text versions of all articles of potential relevance were then retrieved for more detailed independent assessment by two reviewers as before. During this process articles were classified as “include” or “exclude” with reasons for exclusion being documented. Reviewer decisions were compared and any disagreements resolved by consensus.

### Critical appraisal

The quality of all included articles was critically assessed by two independent reviewers using the Newcastle-Ottawa Scale (NOS),<sup>22</sup> a risk of bias assessment tool for non-randomised studies recommended by the Cochrane Collaboration<sup>23</sup> that can be readily tailored for the critical appraisal of quantitative cohort studies.<sup>9</sup> The NOS assesses studies on six items over five broad perspectives: (a) selection bias; (b) measurement of confounders; (c) outcome assessment; (d) follow-up and (e) adjustments for residual confounders (two items). We extended this tool by incorporating features from other published checklists<sup>24 25</sup> to include three additional items to assess (a) study attrition (missing data), (b) statistical methods and (c) data presentation. Studies were scored according to the extent that they met each of the nine assessed criterion (see supplementary appendix 2) using an ordinal scale to rate the risk of bias as 0 (high), 1 (intermediate) and 2 (low) and the individual item scores then summed to give a total quality score. Instances of major differences in total scores



between the two reviewers for individual articles were resolved by consensus and each article was then assigned a summary score (averaged across the two scores). The total average score (range of 0-18) achieved across the nine criterion was categorized as “high” (14-18), “moderate” (9-13.5) or “low” (<9) quality. Studies were not excluded based specifically on their quality rating.

Studies were also classified according to the published levels of evidence for quantitative observational studies from the Australian National Health and Medical Research Council (NHMRC)<sup>24</sup> in decreasing order of strength as Level I, Level II, Level III-1, Level III-2, Level III-3 or Level IV.

**Data extraction**

For all included articles, study characteristics including author(s), publication year, title, population, design and outcomes were recorded in a customized database by one reviewer and subsequently checked by another. Any errors or inconsistencies were resolved after consulting the original source.

**Results**

**Study selection**

The steps in the review process are illustrated in a PRISMA diagram (Figure 1). A total of 444 articles were identified across combined databases with an additional 37 citations from other sources. After removing duplicates, an initial pool of 182 articles remained of which 61 were excluded after initial scanning of title/abstracts. Of the 121 retrieved full-text articles, 52 met the inclusion criteria and were considered relevant to at least one of the clinical questions. Excluded studies are listed in supplementary appendix 3, including reasons for exclusion.

**Study characteristics**

All included articles were quantitative and around 77% used administrative data sources such as population-based cancer registries, screening databases or the non-representative (not population based) National Breast Cancer Audit database which has collected data on about 60% of invasive early breast cancers treated by participating Australian (and New Zealand) breast surgeons since 1998.<sup>26</sup> Remaining studies were based on medical record reviews and cross-sectional surveys.

There was considerable heterogeneity in the definition of non-metropolitan and metropolitan populations. While about half of the included studies used standardized definitions such as the Rural, Remote and Metropolitan Areas (RRMA) system, the Accessibility/Remoteness Index of Australia (ARIA) or ARIA+, or remoteness areas defined by the Australian Standard Geographical Classification,<sup>27</sup> others defined non-metropolitan and metropolitan areas based on distances to services, population density or postcodes. Two studies did not provide detailed information regarding the basis of their geographical classification (Table 2).

1  
2  
3 Around 60% of included studies were graded as high quality, 35% moderate and 5% low quality, with  
4 a mean score of 13.0 and range of 6.5-17.0. Key limiting factors for these scores were that around a  
5 third (29%) of studies did not use a population-based representative sample, while 21% did not adjust  
6 for confounders (including age and socio-demographics). Studies based on reliable and objective data  
7 sources (cancer registries) were limited in their ability to control for clinical and treatment factors.  
8  
9 The use of highly selective or convenience samples and lack of follow-up also reduced study quality.  
10  
11 No studies provided Level I evidence, while more than half (53%) gave Level II evidence, 39% Level  
12 III-3 and 8% Level-IV evidence (Table 2).  
13  
14

## 15 **Key findings**

16  
17 Studies are summarized below according to clinical questions within each of the key themes: 1)  
18 survival outcomes, 2) patient/tumour characteristics and 3) diagnostic and treatment outcomes.  
19  
20 Several studies reported on multiple outcomes. The emphasis is on whether there was evidence of  
21 variations in relevant outcomes by residential location and, if so, the direction and a quantitative  
22 estimate of the magnitude of the effect. Given the considerable heterogeneity among studies in terms  
23 of their quality, levels of evidence, time period and geographical definitions, we have deliberately  
24 interpreted any summary patterns with caution.  
25  
26  
27

## 28 **Survival Outcomes**

29  
30 There was a consistent pattern of significantly poorer survival (in unadjusted analyses) for women in  
31 non-metropolitan areas compared to metropolitan women across 13 (12 high and one moderate  
32 quality) of 14 included studies both nationally<sup>28 29</sup> and at the state-level (Table 3).<sup>30-40</sup> The five-year  
33 unadjusted relative survival for female breast cancers was about 2-5% (absolute) lower for non-  
34 metropolitan than metropolitan women. The one exception was an early high quality study involving  
35 women in New South Wales (diagnosed from 1980-1991) that did not report any survival  
36 differential.<sup>41</sup>  
37  
38  
39  
40

41 However, no geographical differential in survival was evident across nine<sup>29 33-39 41</sup> of twelve studies  
42 that also reported survival estimates after adjustment for various combinations of known survival  
43 determinants including socio-demographic characteristics, spread of disease, comorbidities and  
44 treatment-related factors. The remaining three studies<sup>30-32</sup> all reported poorer survival for non-  
45 metropolitan women even after adjustment.  
46  
47  
48

49 The adjusted results varied according to the combination of variables included in the statistical  
50 models. Two of the three papers that reported significant differentials after adjusting for a measure of  
51 stage at diagnosis did not consider comorbidities or treatment-related factors.<sup>30 31</sup> Of the five studies  
52 that adjusted for treatment-related factors, four reported no evidence of a survival differential<sup>35-38</sup>  
53  
54  
55

while the finding of a significant difference was likely to be limited to women diagnosed prior to the mid-1990s in the remaining study.<sup>32</sup>

**Patient and Tumour Characteristics**

*Patient characteristics*

Both of the included high quality studies that reported a positive association between area disadvantage and non-metropolitan residence were based on analysis of 30,299 early invasive female breast cancer cases from the National Breast Cancer Audit (Table 4).<sup>42 43</sup> For example, compared to affluent women, socio-economically disadvantaged women diagnosed with breast cancer were 17 times more likely to live in remote areas (than metropolitan areas)<sup>42</sup> while compared to metropolitan women, those from remote areas were 13 times more likely to live in a disadvantaged rather than more advantaged region.<sup>43</sup>

*Tumour characteristics*

No consistent pattern of variations in tumour characteristics by residential location were evident across the 10 included studies (Table 4). Nationally, one high quality study found that non-metropolitan women were 15% more likely to present with tumours >40mm (versus <30mm)<sup>26</sup> while two state-based high quality studies also reported similar patterns,<sup>44 45</sup> despite using different definitions of advanced disease. However, six others (four high, two moderate quality) showed no differences<sup>30 36 40 46-48</sup> and one (high quality) that metropolitan women were 11% more likely to present with regional disease than non-metropolitan patients, but equally likely to present with distant tumours.<sup>39</sup>

**Diagnostic and Treatment Outcomes**

Studies described here assessed geographical variations in relation to two broad topics: breast cancer screening (Table 5) and treatment (Table 6). The target group for the two screening questions refers to women aged 50 to 69 who were eligible (at the time of this review) for the free population-based national mammographic program in Australia (BreastScreen Australia).<sup>49</sup>

*Screening rate*

All six of the included moderate quality studies relate to the publicly funded BreastScreen program, as there were no data available to assess variations in private mammography, which provided mixed results. An analysis of self-reported data among 11,200 women nationally found that despite poorer access to mammography services, non-metropolitan women had similar screening rates to metropolitan women,<sup>50</sup> consistent with an earlier cross sectional survey.<sup>51</sup> Two state-based studies however reported higher participation rates in the BreastScreen program for non-metropolitan

women.<sup>52 53</sup> In contrast women in the target age group who lived within 10-20 km of a relocatable BreastScreen service were 43% less likely to have attended the service than those residing within a 2 km radius of the service.<sup>54</sup> Another study found that non-metropolitan women in the target age group were 39% more likely to report never having had a mammogram through BreastScreen Australia than metropolitan women.<sup>55</sup> Screening history, perceived breast cancer risk and knowledge about service location were among key predictors of accessing a relocatable screening service in a study involving only 180 non-metropolitan women.<sup>56</sup>

### *Rescreening*

Results were inconsistent across the four included studies, with a dependence on the time period of data collection. One early (moderate quality) study showed that metropolitan women had higher rescreening rates through the free national BreastScreen program than non-metropolitan women<sup>55</sup> whereas among three other studies from 1995 onwards, one (moderate quality) study showed no difference in rescreening rates<sup>57</sup> and two studies (one moderate, one high quality) showed that non-metropolitan women had higher rescreening rates.<sup>50 58</sup>

### *Clinical management*

Given there are separate Australian guidelines for clinical management of early<sup>59</sup> and advanced stage breast cancer,<sup>60</sup> the descriptions of variations in clinical management are categorised accordingly.

A consistent pattern of variations in the clinical management of early breast cancer by residential location was evident across 19 (13 high, five moderate, one low quality) of the 20 included studies with only one moderate quality study finding no variations.

Among 30,299 cases extracted from the National Breast Cancer Audit database, non-metropolitan women were at least five times more likely to have a mastectomy than metropolitan women<sup>26</sup> while another study using this database reported that the proportion of mastectomies progressively increased with increasing remoteness.<sup>61</sup> Various state-specific studies reported similar patterns<sup>62-67</sup> although the effect was not always statistically significant.<sup>63 64</sup> Studies using the National Breast Cancer Audit database also found that non-metropolitan women were 6% less likely to undergo breast conserving surgery<sup>42</sup> and that the proportion who had breast conserving surgery decreased progressively with increasing remoteness.<sup>61</sup> Similar findings were evident across six other studies.<sup>36 45 62 68-70</sup>

Two studies based on the National Breast Cancer Audit Database reported that non-metropolitan women were up to 20% less likely to receive adjuvant radiotherapy than metropolitan women.<sup>42 61</sup> Moreover women residing in areas lacking radiotherapy facilities had a higher likelihood (23%) of not receiving radiotherapy than those from regions with such facilities.<sup>61</sup> At the state-level, non-metropolitan women were also less likely to receive adjuvant radiotherapy after breast conserving

surgery in Victoria and Western Australia,<sup>45</sup> although in Western Australia this effect was not statistically significant for metropolitan women.<sup>36</sup>

Compared to non-metropolitan women, metropolitan women had a 10% lower risk of unplanned readmissions.<sup>71</sup> Non-metropolitan women were less likely to undergo sentinel node biopsies (SNB),<sup>72</sup> for example 82% of metropolitan women had a SNB compared to 66% of non-metropolitan women. Non-metropolitan women were also less likely to receive hormonal therapy compared to metropolitan women (74.5% versus 84.6%,  $p=0.006$ )<sup>36</sup> and 13-46% less likely to receive breast reconstruction<sup>73-75</sup> although adjusted effects were not always significant.<sup>74 75</sup> Both low surgical caseload ( $\leq 10$  cases/year) and non-metropolitan treatment centres were also independent predictors of lower immediate breast reconstruction following mastectomy.<sup>75</sup> However there were no geographical variations in rates of axillary node surgery<sup>64 67 68</sup> or access to specialist breast care nurses.<sup>76</sup> Compared to metropolitan women, non-metropolitan women were either equally as likely<sup>36 70</sup> or even more likely<sup>42</sup> to receive adjuvant chemotherapy.

Of the four included studies comprising non-metropolitan women only, one reported that breast care nurses were important in ensuring continuity of care,<sup>77</sup> two found a high level of patient satisfaction with the treatment decision process<sup>78 79</sup> and one found that geographical setting was no impediment to receiving breast conserving surgery or to accessing multidisciplinary care at a single non-metropolitan treatment centre.<sup>80</sup>

The only study examining geographical variations in clinical management for advanced breast cancer was one early study that reported no geographical variations in mastectomy rates among women with metastatic disease.<sup>62</sup>

*Recommended clinical management*

Six (three high, three moderate quality) of 10 included studies reported geographical variations in guideline-concordant care with non-metropolitan women being less likely to undergo adjuvant radiotherapy,<sup>42 45 61</sup> hormonal therapy<sup>36</sup> or sentinel node biopsies<sup>72</sup> and more likely to experience longer delays in commencing adjuvant chemotherapy.<sup>46</sup> However the other four studies (two high, two moderate quality) found no significant geographical variations in receipt of recommended care.<sup>64</sup>

*Referral*

Non-metropolitan women were less likely to be referred to a radiation oncologist,<sup>70</sup> and were more likely to experience delays in assessment by a medical oncologist.<sup>46</sup> Further, in a cross-sectional survey of 70 non-metropolitan women, 42% were referred to another health professional before surgery.<sup>79</sup> All studies were of moderate quality.

International studies have consistently shown geographical variations in access to high volume surgical care<sup>81-83</sup> and provided clear evidence that such care is related to improved breast-cancer survival<sup>82 84</sup> and better concordance with clinical care guidelines.<sup>85 86</sup> Hence eligible studies that described access to high caseload surgeons were also considered for this clinical question. One high-quality study reported that non-metropolitan women were 9% more likely to be treated locally by low caseload surgeons<sup>26</sup> (defined as  $\leq 10$  or  $< 20$  cases/year) with similar findings reported by two other high quality studies.<sup>36 42</sup>

### *Treatment completion*

Of the two included studies one found that non-metropolitan women were more likely to complete prescribed chemotherapy than metropolitan women.<sup>46</sup> Another reported that women treated by low caseload surgeons ( $\leq 20$  cases/year) were more likely to decline breast conserving surgery, mastectomy, radiotherapy, axillary surgery and chemotherapy based on data from the National Breast Cancer Audit.<sup>87</sup>

The review did not identify any studies examining geographical variations in the specific treatment options offered to non-metropolitan and metropolitan Australian female breast cancer patients, or post-treatment follow-up according to current national guidelines.<sup>88</sup>

## **Discussion**

This review found consistent evidence for variations in survival and clinical management, limited evidence for variations in diagnostic outcomes and inconsistent evidence for variations in tumour characteristics by residential location of Australian female breast cancer patients.

While gaps in the literature limited our ability to draw clear links between identified variations and the drivers of these variations, there was good evidence that poorer breast cancer survival for non-metropolitan women reflects more advanced disease at diagnosis, greater comorbidities and treatment-related factors. According to the recent systematic review by the International Agency for Research on Cancer (IARC)<sup>89</sup> there is sufficient evidence for the efficacy of mammographic screening in reducing breast-cancer mortality for women aged 50 to 69 years. In Australia, increasing participation for groups with low screening rates can be achieved through the existing and well established population-based national mammographic program (BreastScreen). Targeted strategies are required including thorough engagement and communication with primary care to improve screening participation rates.<sup>49</sup> While data on screening participation through BreastScreen is readily available, the lack of data on the number of privately screened women precludes an evaluation of actual population-based screening participation. Hence it remains a priority to explore means to combine

data on public and private screening to gain more comprehensive information on total rates of breast cancer screening nationally.

The review found a consistent pattern of geographical variations in patterns of care and lower receipt of optimal clinical management for early breast cancer among non-metropolitan women in Australia. Reasons for these variations likely included limited access to oncological services and multidisciplinary care. It is envisaged that the establishment of Regional Cancer Centres across Australia and integrated cancer networks should improve access to oncological care for regional patients.<sup>15 18</sup> However the challenge of overcoming barriers to multidisciplinary care in regional areas remains a key issue, especially as multidisciplinary care is widely considered to be the gold standard of cancer care and has been consistently shown to improve breast cancer-related clinical outcomes.<sup>90</sup> As such, initiatives should be implemented to ensure that all women undergo comprehensive multidisciplinary team assessment and that all relevant treatment options are considered.

Australian clinical practice guidelines for the management of early breast cancer recommend post-operative radiotherapy after breast conserving surgery to reduce the risk of local recurrence, adjuvant endocrine therapy and/or chemotherapy where appropriate based on hormone receptor status,<sup>91</sup> and sentinel node biopsy offered to women with unifocal clinically node negative tumours ( $\leq 30\text{mm}$ ).<sup>92</sup> However this review found limited but consistent evidence for geographical variations in receipt of care according to these guidelines. Specifically, non-metropolitan women were less likely to undergo adjuvant radiotherapy,<sup>42 45 61</sup> hormonal therapy,<sup>36</sup> or sentinel node biopsies.<sup>72</sup> Lower utilization of sentinel node biopsies in non-metropolitan areas may reflect difficulties in obtaining required radiopharmaceuticals for this procedure as well as less relevant training and experience in performing these procedures among general surgeons outside major treatment centres.<sup>72</sup> Surgeon-level interventions may be required to help improve sentinel node biopsy rates and hence quality of care and reduced morbidity.

The finding that non-metropolitan women were less likely to receive adjuvant radiotherapy likely reflects variations in access to such facilities. However it should be acknowledged that all included studies were published in the period 1<sup>st</sup> January 1990 to 1<sup>st</sup> March 2015 and that some earlier studies may not reflect current practice and/or the impact of improved access to radiation services with the development of new radiotherapy infrastructure in regional Australia over the last five years.<sup>15 93</sup> A study published after the review found that breast conserving surgery rates among regional women in the state of New South Wales increased significantly after the opening of a publicly funded local radiotherapy facility in 2013, compared to earlier years when the only options were a local private or publicly funded out-of-areas services.<sup>94</sup> Data at the state-level (Victoria, New South Wales) also indicate temporal improvements in the waiting time from specialist consultation to commencing



prescribed radiotherapy (for any cancer)<sup>95</sup> although these figures are based on the interval from time of radiation oncologist assessment to starting radiotherapy and not from the time of diagnosis. The implementation of routine reporting of waiting times from the time of diagnosis to commencing radiotherapy by geographical location would help identify when and where delays in referral and commencement of treatment occur.

While the review found consistent evidence for variations in breast cancer survival and clinical management, patterns were inconsistent for other outcomes, primarily due to heterogeneity of the included studies or in some cases a lack of studies. A recent study using data from the Australian state of New South Wales published following this review showed that, although survival had improved across population groups, non-metropolitan women continued to experience poorer survival compared to metropolitan women.<sup>96</sup> These findings emphasise the importance of Cancer Australia's (Australia's national cancer control agency) work in establishing a national comprehensive system for recording breast cancer stage and clinical management at the population level thereby enabling accurate monitoring of the effectiveness of strategies and initiatives to improve breast cancer outcomes for non-metropolitan women in Australia.

On an international scale, inequities in access to specialised care<sup>81-83</sup> and geographical variations across the breast cancer continuum including screening,<sup>7</sup> stage at diagnosis<sup>9 97</sup> and patterns of care<sup>8 86 97-102</sup> are well documented. There is widespread consensus that these variations reflect a combination of socio-economic, demographic and environmental factors including geography, comorbidities, access, treatment and stage at diagnosis that defy easy solutions.<sup>7-9 82 83 97 101</sup> The persistence of such inequities even for universal (publicly-funded) health-care systems<sup>7 82 97 99 102</sup> highlights the complexity of the underlying issues.

## Limitations

A number of issues made direct comparisons and to some extent interpretation of findings across studies particularly challenging. The assessment of comparability was hampered by the wide variability in study quality, levels of evidence, methodology, data sources, time period and terminology. These issues also prevented meta-analyses being carried out. Many studies were predominantly conducted at the state-level, making the generalisation of findings to the national level difficult. The review also highlighted the need to improve and standardize definitions of geographical location to produce more uniform and reliable remoteness classifications. This would improve data comparability in terms of residential location and hence facilitate more definitive conclusions to be drawn on the strength of the available evidence. Similar concerns have been noted by international reviews on area-level variations in other cancer outcomes.<sup>8 103 104</sup>



Moreover, many studies had important limitations including selection bias and inadequate follow-up that impacted their quality. While using registry data allows generalizability of findings, such studies cannot comprehensively control for all potential confounders, especially those related to clinical and treatment factors as Australian cancer registries do not routinely collect treatment information.

Considerable efforts were made to conduct a comprehensive search of existing literature on specified clinical questions by searching multiple databases with complex queries and evaluating reference lists of identified articles, published reviews and government reports to find additional articles. However, it is still possible that the search term criteria used could have unintentionally resulted in exclusion of relevant articles. Included articles were also limited to those indexed in the accessed databases.

**Conclusions**

By examining the current evidence relating to geographical variations in breast cancer outcomes across the continuum of care for Australian women, this review has important implications for clinical practice, service delivery and future research. It has highlighted the gap in knowledge of variations in the treatment of advanced breast cancers, patient decision making and post-treatment follow-up.

While addressing the geographical variations in breast cancer survival and clinical management will require a multifaceted approach, initial efforts could include improving access to and participation in breast screening programs, raising awareness of the benefits of early detection and enabling all women diagnosed with breast cancer to be assessed by a multidisciplinary team that considers all relevant treatment options and have access to best practice treatment. Recognising the heterogeneity of existing studies in terms of geographical coverage and definitions, the establishment of a national comprehensive system for recording breast cancer stage and clinical management would enable accurate monitoring of the success of these initiatives.

Finally, encouraging evidence-based research aimed at better understanding the reasons for geographical variations in breast cancer management and outcomes at each stage of the continuum of care needs to be a priority to inform the development of targeted initiatives to improve survival and quality of life for rural and remote women with breast cancer in Australia.

## **Funding**

This project was funded by Cancer Australia. Dr Philippa Youl is funded by a National Health and Medical Research Council Early Career Fellowship (#1054038).

## **Conflict of Interest**

The authors report no conflict of interest.

## **Authors Contributions**

All authors contributed to the design of the study. PY and PB coordinated the study; PD conducted the literature searches and drafted the manuscript; PD, PY, DY and PB all acted as reviewers and participated in data collection; PY, PB, DY, JA and GG contributed to the initial draft of the manuscript and all authors refined and approved the final version of the paper.

## **Acknowledgements**

The project was commissioned and funded by Cancer Australia. The authors would like to acknowledge the advice of the Project Steering Committee.

## **Data sharing statement**

No additional data are available

## **Patient consent**

Not relevant

**Figure legends**

Figure 1: Process of inclusion and exclusion of studies for the systematic review

**Supplementary files**

**Supplementary file 1 Database-specific search queries by individual clinical questions.**

Additional file 1 lists search queries for the searched databases by each of the individual clinical questions in numerical order.

*File name: Supplementary file 1.pdf*

**Supplementary file 2 Quality appraisal tools for included quantitative studies.** Additional file 2 shows the scoring system used for quality appraisal of the included quantitative studies.

*File name: Supplementary file 2.pdf*

**Supplementary file 3 Excluded studies with reasons for exclusion.** Additional file 3 lists the excluded studies with reasons for exclusion in alphabetical order by author.

*File name: Supplementary file 3.pdf*

**Table 1: Clinical questions guiding the systematic review****Survival Outcomes**

1. In women diagnosed with breast cancer, do non-metropolitan women have poorer breast cancer survival compared to metropolitan women in Australia?

**Patient and Tumour Characteristics**

2. In women diagnosed with breast cancer, do non-metropolitan women have different socio-demographic characteristics compared to metropolitan women in Australia?

3. In women diagnosed with breast cancer, do non-metropolitan women have more advanced tumour characteristics compared to metropolitan women in Australia?

**Diagnostic and Treatment Outcomes**

4. In women diagnosed with breast cancer, are non-metropolitan women in the breast screening target group less likely to access breast screening services compared to metropolitan women in Australia?

5. In women diagnosed with breast cancer, are non-metropolitan women in the breast screening target group less likely to adhere to recommended breast screening intervals (2 yearly) compared to metropolitan women in Australia?

6. In women diagnosed with breast cancer, are there differences in the clinical management between non-metropolitan and metropolitan women in Australia?

7. In women diagnosed with breast cancer, are non-metropolitan women less likely to receive the recommended clinical management compared to metropolitan women in Australia?

8. In women diagnosed with breast cancer, are non-metropolitan women more likely to experience delays in referral to breast cancer specialist clinicians compared to metropolitan women in Australia?

9. In women diagnosed with breast cancer, do non-metropolitan women experience fewer treatment options compared to metropolitan women in Australia?

10. In women diagnosed with breast cancer, are non-metropolitan women less likely to complete prescribed treatment compared to metropolitan women in Australia?

11. In women diagnosed with breast cancer, are non-metropolitan women less likely to participate in recommended follow-up compared to metropolitan women in Australia?

**Table 2: Summary scores, overall grades and Levels of evidence for included studies**

Study	Metropolitan/non-metropolitan definition	Score <sup>2</sup>	Quality <sup>3</sup>	Level <sup>4</sup>
Adelson <i>et al</i> 1997 <sup>62</sup>	Based on health services	15	High	III-3
AIHW 2013 <sup>28</sup>	ARIA+ Remoteness Index	14.5	High	II
Azzopardi <i>et al</i> 2014 <sup>61</sup>	ASGC	9	Moderate	II
Baade <i>et al</i> 2011 <sup>44</sup>	ARIA+ Remoteness Index	16.5	High	II
Barratt <i>et al</i> 1997 <sup>51</sup>	RRMA Classification	9.5	Moderate	II
Bell <i>et al</i> 2012 <sup>73</sup>	Postcodes <sup>1</sup>	15	High	II
Bonnet <i>et al</i> 1990 <sup>30</sup>	Postcodes <sup>1</sup>	14.5	High	II
Budden <i>et al</i> 2014 <sup>78</sup>	N/A – regional women only	10	Moderate	IV
Campbell <i>et al</i> 2006 <sup>76</sup>	Based on place of residence	9.5	Moderate	III-3
Chen <i>et al</i> 2015 <sup>31</sup>	ARIA+ Remoteness Index	15.5	High	II
Clayforth <i>et al</i> 2007 <sup>32</sup>	Postcodes <sup>1</sup>	15	High	II
Cockburn <i>et al</i> 1997 <sup>56</sup>	N/A – rural and remote women only	10	Moderate	III-3
Craft <i>et al</i> 1997 <sup>68</sup>	RRMA Classification	12	Moderate	III-3
Cramb <i>et al</i> 2012 <sup>33</sup>	Distance to radiation treatment facilities	15.5	High	II
Dasgupta <i>et al</i> 2012 <sup>34</sup>	ARIA	16.5	High	II
Eley <i>et al</i> 2008 <sup>77</sup>	N/A– rural and remote women only	7.5	Low	IV
Fox <i>et al</i> 2013 <sup>46</sup>	RRMA Classification	10.5	Moderate	III-3
Hall & Holman 2003 <sup>74</sup>	ARIA	14.5	High	II
Hall <i>et al</i> 2004a <sup>35</sup>	ARIA	15	High	II
Hall <i>et al</i> 2004b <sup>69</sup>	ARIA	14.5	High	II
Hill <i>et al</i> 1994 <sup>70</sup>	Postcodes <sup>1</sup>	12.5	Moderate	II
Hughes <i>et al</i> 2014 <sup>57</sup>	Postcodes <sup>1</sup>	10.5	Moderate	III-3
Kok <i>et al</i> 2006 <sup>45</sup>	RRMA Classification	14.5	High	III-3
Koshy <i>et al</i> 2005 <sup>63</sup>	Postcodes <sup>1</sup>	9.5	Moderate	III-3
Kricker <i>et al</i> 2001 <sup>64</sup>	Unclear	16	High	II
Lai <i>et al</i> 2007 <sup>71</sup>	RRMA Classification	15	High	II
Leung <i>et al</i> 2014 <sup>50</sup>	ARIA+ Remoteness Index	12.5	Moderate	III-3
Lord <i>et al</i> 2012 <sup>47</sup>	ARIA	14	High	II
Luke <i>et al</i> 2004 <sup>48</sup>	Postcodes <sup>1</sup>	14	High	II
Martin <i>et al</i> 2006 <sup>65</sup>	Based on place of residence	14.5	High	II
Mastaglia & Kristjanson 2001 <sup>66</sup>	Unclear	6.5	Low	IV
Mitchell <i>et al</i> 2006 <sup>36</sup>	Postcodes <sup>1</sup>	16	High	II
Morris <i>et al</i> 2012 <sup>72</sup>	ASGC	10.5	Moderate	III-3
O’Byrne <i>et al</i> 2000 <sup>58</sup>	RRMA Classification	15.5	High	III-3
Ristevski <i>et al</i> 2012 <sup>79</sup>	N/A - regional women only	9	Moderate	IV

Study	Metropolitan/non-metropolitan definition	Score <sup>2</sup>	Quality <sup>3</sup>	Level <sup>4</sup>
Roder <i>et al</i> 2012a <sup>29</sup>	ASGC	14.5	High	III-3
Roder <i>et al</i> 2012b <sup>87</sup>	ASGC	14	High	III-3
Roder <i>et al</i> 2013a <sup>42</sup>	ASGC	14	High	III-3
Roder <i>et al</i> 2013b <sup>26</sup>	ASGC	14.5	High	III-3
Roder <i>et al</i> 2013c <sup>75</sup>	ASGC	14.5	High	III-3
Roder <i>et al</i> 2014 <sup>43</sup>	ASGC	15	High	III-3
Schofield <i>et al</i> 1994 <sup>54</sup>	Distance to screening services	10.5	Moderate	II
Siapush & Singh 2002 <sup>55</sup>	Based on residential area	12.5	Moderate	II
Spilsbury <i>et al</i> 2005 <sup>37</sup>	Postcodes <sup>1</sup>	16	High	II
Sullivan <i>et al</i> 2003 <sup>52</sup>	Postcodes <sup>1</sup>	11	Moderate	III-3
Supramaniam <i>et al</i> 2014 <sup>38</sup>	ARIA+ Remoteness Index	17	High	II
Taylor 1997 <sup>41</sup>	(1) 16 regional areas (2) capital city, other metropolitan, rural	14.5	High	II
Thompson <i>et al</i> 2008 <sup>67</sup>	ARIA+ Remoteness Index	14.5	High	II
Tracey <i>et al</i> 2008 <sup>39</sup>	ARIA	15	High	II
Tulloh & Goldsworthy 1997 <sup>80</sup>	N/A - all from rural and remote areas.	7	Low	III-3
Weber <i>et al</i> 2014 <sup>53</sup>	ARIA+ Remoteness Index	10.5	Moderate	III-3
Wilkinson & Cameron 2004 <sup>40</sup>	Postcodes <sup>1</sup>	9.5	Moderate	II

ARIA Accessibility/Remoteness Index of Australia; ASGC Australian Standard Geographical Classification; N/A Not applicable; RRMA Rural, Remote and Metropolitan Areas

1. Postcodes within state capital were considered metropolitan, remaining were non-metropolitan
2. Average score over scores from two independent reviewers. Please refer to text for further details.
3. Quality categories: High (score 14-18), Moderate (score 9-13.5) or Low (score <9); please refer to text for further details.
4. Australian National Health and Medical Research Council (NHMRC)<sup>24</sup> levels of evidence in decreasing order of strength are Level I, Level II, Level III-1, Level III-2, Level III-3 and Level IV.

**Table 3.** Characteristics of included studies on survival outcomes

Study	Location <sup>1</sup>	Design	Source	Period (follow-up)	Sample <sup>2</sup>	Outcomes	Analysis	Results
AIHW 2013 <sup>28</sup>	National	Cohort	ACD	1982-2007 (end 2010)	NS	5-year relative survival	Relative survival	Poorer survival for remote/very remote women (84% versus 90% major cities). <sup>3</sup>
Bonnet <i>et al</i> 1990 <sup>30</sup>	SA	Cohort	SA CR	1980-1986 (end 1988)	2,565	5-year relative survival	Proportional hazards regression	Poorer survival for non-metropolitan women (74% versus 76-78% metropolitan). They had significantly poorer (p<0.05) survival (2-9 times higher mortality risk) after adjustment. <sup>4</sup>
Chen <i>et al</i> 2015 <sup>31</sup>	NSW	Cohort	NSW CCR	2000-2008	36,867	5-year BC specific-survival	Kaplan-Meier, stratified Cox regression (spread of disease)	Poorer survival for outer regional women with regional (82% versus 86% metropolitan) and distant (33% versus 44%) disease. Outer regional women also had significantly (p<0.05) poorer survival (regional: 22%; distant: 30% higher BC mortality) after adjustment. <sup>5</sup>
Clayforth <i>et al</i> 2007 <sup>32</sup>	WA	Cohort	WA CR	1989, 1994, 1999 (to 2005)	1,729	5-year overall survival	Kaplan-Meier, Cox regression	Poorer survival for non-metropolitan women (79% versus 85% metropolitan, p=0.014). Metropolitan women had significantly (p<0.001) better survival (30% lower BC mortality) after adjustment. <sup>6</sup>
Cramb <i>et al</i> 2012 <sup>33</sup>	Qld	Cohort	Qld CR	1996-2007	25,202	5-year relative survival	Bayesian spatial regression	Poorer survival for women living >6 hours from a radiation facility (83% versus 86% living <2 hours, p<0.001). No statistically significant difference after adjustment. <sup>7</sup>
Dasgupta <i>et al</i> 2012 <sup>34</sup>	Qld	Cohort	Qld CR	1997-2006 (end 2007)	18,568, first primary, aged 30-79 years	5-year BC specific-survival	Kaplan-Meier, Multilevel regression	Poorer survival for remote/very remote women (88% versus 91% metropolitan, p=0.022). No statistically significant (p=0.366) difference after adjustment. <sup>8</sup>
Hall <i>et al</i> 2004a <sup>35</sup>	WA	Cohort	WA Record Linkage Project	1991-2001	7,117, BC-surgery	5-year overall survival	Chi-square, Cox regression	Poorer survival for very remote women (78% versus 83% metropolitan). No statistically significant difference after adjustment. <sup>9</sup>
Mitchell <i>et al</i> 2006 <sup>36</sup>	WA	Cohort	WA CR	1999 (end 2004)	899, first primary, histologically verified	5-year overall survival	Kaplan-Meier, Cox regression	Poorer survival for non-metropolitan women (78% versus 87% metropolitan, p=0.001). No statistically significant difference after adjustment. <sup>10</sup>
Roder <i>et al</i> 2012a <sup>29</sup>	National	Cohort, data linkage	BS Australia, state cancer registries	1991-2006	62,082, screening history (BS Australia)	5-year overall & BC specific survival	Cox regression	Poorer survival for regional non-Indigenous (88-89% versus 90% metropolitan) and Indigenous women (75-79% versus 86%). No statistically significant difference after adjustment. <sup>11</sup>
Spilsbury <i>et al</i> 2005 <sup>37</sup>	WA	Cohort	WA Record Linkage Project	1982-2000	11,445, BC-surgery	5-year relative & BC specific survival	Relative survival, Cox regression	Poorer survival for non-metropolitan women (82% versus 86% metropolitan, p<0.001). No statistically significant (p≥0.05) difference after adjustment. <sup>12</sup>
Supramaniam	NSW	Cohort,	NSW CCR,	2001-2007 (end	27,850, aged	5-year BC	Cox regression	Inner regional and rural women had (unadjusted) 11% and

Study	Location <sup>1</sup>	Design	Source	Period (follow-up)	Sample <sup>2</sup>	Outcomes	Analysis	Results
<i>et al</i> 2014 <sup>38</sup>		data linkage	NSW APDC	2008)	≥18 years	specific-survival		20% poorer survival respectively than metropolitan women. No statistically significant (p=0.703) difference after adjustment. <sup>13</sup>
Taylor 1997 <sup>41</sup>	NSW	Cohort	NSW CCR	1980-1991 (end 1992)	25,793	5-year relative survival	Relative survival models	No statistically significant (p≥0.05) differences in either unadjusted or adjusted <sup>14</sup> survival estimates by residential location.
Tracey <i>et al</i> 2008 <sup>39</sup>	NSW	Cohort	NSW CCR	1980-2003 (end 2004)	59,731, known spread of disease	Case fatality: 5 and 10 years post-diagnosis	Kaplan-Meier, Cox regression	Poorer survival for non-metropolitan women than metropolitan women. No statistically significant (p≥0.05) difference after adjustment. <sup>15</sup>
Wilkinson & Cameron 2004 <sup>40</sup>	SA	Cohort	SA CR	1977-1993 (to 2000)	NS	5-year BC specific-survival	Survival percentages	Poorer survival for non-metropolitan women (73% versus 77% metropolitan). <sup>3</sup>

ACD Australian Cancer Database, APDC Department of Health Admitted Patient Data Collection, BC Breast Cancer, BS BreastScreen, CR Cancer Registry, CCR Central Cancer Registry, NS not stated

1. National: all states/territories; NSW: New South Wales; Qld: Queensland; SA: South Australia and WA Western Australia
2. Female invasive breast cancers cases
3. No adjusted analyses
4. Adjusted for tumour size and nodal status.
5. Adjusted for age at diagnosis and stratified by spread of disease (classified as localised, regional or distant).
6. Adjusted for age and year at diagnosis, clinical features, surgical caseload and treatment related factors.
7. Adjusted for age at diagnosis, spread of disease, distance to treatment and area-disadvantage.
8. Adjusted for age at diagnosis, Indigenous status, socio-demographic factors, spread of disease and area-disadvantage.
9. Adjusted for age and year at diagnosis, Indigenous status, socio-demographic factors, comorbidities, area-disadvantage, hospital related factors and surgical type.
10. Adjusted for age at diagnosis, clinical features, surgical caseload and treatment related factors.
11. Adjusted for age at diagnosis, diagnostic period, Indigenous status and area-disadvantage.
12. Adjusted for age at diagnosis, diagnostic period, Indigenous status, comorbidities, area-disadvantage, hospital type and treatment related factors.
13. Adjusted for age and year at diagnosis, Indigenous status, comorbidities, area-disadvantage, spread of disease and surgical type.
14. Adjusted for age at diagnosis, spread of disease, follow-up interval and interactions between these variables.
15. Adjusted for age at diagnosis, diagnostic period, spread of disease, area-disadvantage and country of birth



**Table 4.** Characteristics of included studies on patient and tumour characteristics

Study	Location <sup>1</sup>	Design	Source	Period	Sample <sup>2</sup>	Outcomes	Analysis	Results
Roder <i>et al</i> 2013a <sup>42</sup>	National	Non-representative sample	NBCA database <sup>3</sup>	1998-2010	30,299, early disease <sup>4</sup> , residential postcodes noted	Predictors of increasing residential remoteness for women with BC	Chi-square, Logistic regression	Disadvantaged women (versus affluent) significantly (p<0.001) more likely to live in inner regional (10 times), outer regional (33 times) or remote areas (17 times) than metropolitan areas. Residential disadvantage a key predictor of increasing remoteness after adjustment. <sup>5</sup>
Roder <i>et al</i> 2014 <sup>43</sup>	National	Non-representative sample	NBCA database <sup>3</sup>	1998-2010	30,299, early disease <sup>4</sup> , residential postcodes noted	Predictors of lower residential socioeconomic status for women with BC	Chi-square, Logistic regression	Low socioeconomic status significant (p<0.001) predictor of non-metropolitan residence. Inner regional (five times, versus metropolitan), outer regional (10 times) and remote women (13 times) significantly more likely to live in disadvantaged than affluent regions after adjustment. <sup>6</sup>
Baade <i>et al</i> 2011 <sup>44</sup>	Qld	Cohort	Qld CR	1997-2006	18,568, aged 30-79 years, known tumour size and nodal status (if ≤20mm)	Stage <sup>7</sup>	Multilevel logistic regression	Outer regional women 13% (p<0.001) more likely to present with advanced disease than metropolitan women after adjustment. <sup>8</sup>
Bonnet <i>et al</i> 1990 <sup>30</sup>	SA	Cohort	SA CR	1980-1986	1,171, known tumour size and nodal status	Tumour size, nodal status	Chi-square	No statistically significant (p>0.10) differences in tumour size or nodal status by residential location.
Fox <i>et al</i> 2013 <sup>46</sup>	NSW	Medical chart reviews	Records (4 medical centres)	2008-2011	400, Stage 1-III, had adjuvant CT, consulted medical oncologist	Median tumour size, grade, receptor status, nodal status	Chi-square, Mann-Whitney	No statistically significant differences in tumour size by residential location. Non-metropolitan women significantly (p ≤0.01) more likely to have triple negative, low grade or greater nodal spread tumours.
Kok <i>et al</i> 2006 <sup>45</sup>	Vic	Retrospective cohort	BS Vic	1993-2000	5,294 diagnosed through screening	Tumour size, nodal status	Chi-square	Non-metropolitan women had larger tumours (10-19mm: 49% versus 47% metropolitan; >20mm: 25% versus 23%, p<0.001); no statistically significant (p≥0.05) difference in nodal status by residential location.
Lord <i>et al</i> 2012 <sup>47</sup>	NSW	Cohort	NSW CR	2001-2002	6,664, non-metastatic, known spread of disease	Degree of spread <sup>9</sup>	Chi-square	No statistically significant (p=0.08) difference in degree of spread by residential location.
Luke <i>et al</i> 2004 <sup>48</sup>	SA	Cohort	SA CR	1997-2002	4,912, known tumour size	Large tumour (≥30mm)	Mann-Whitney	No statistically significant (p=0.130) difference in tumour size by residential location.
Mitchell <i>et</i>	WA	Cohort	WA CR	1999	899, first primary,	Tumour size, grade,	Chi-square	No statistically significant (p≥0.103)

Study	Location <sup>1</sup>	Design	Source	Period	Sample <sup>2</sup>	Outcomes	Analysis	Results
<i>al</i> 2006 <sup>36</sup>					histologically verified	vascular invasion, nodal status		differences in tumour size or other clinical characteristics by residential location.
Roder <i>et al</i> 2013b <sup>26</sup>	National	Non-representative sample	NBCA database <sup>3</sup>	1998-2010	30,299, early disease <sup>4</sup> , residential postcodes noted	Tumour size, grade, vascular invasion, receptor status, nodal status	Chi-square, Mann-Whitney	More remote women (outer-regional, remote/very remote areas combined) 15% (p=0.005) more likely to present with larger tumours ( $\geq 40$ mm versus $< 30$ mm) than metropolitan women. No statistically significant (p $\geq 0.046$ ) differences in other clinical features by residential location.
Tracey <i>et al</i> 2008 <sup>39</sup>	NSW	Cohort	NSW CCR	1980-2003	59,731, known spread of disease	Degree of spread <sup>9</sup>	Logistic regression	Metropolitan women 11% more likely to present with regional disease than non-metropolitan women after adjustment. <sup>10</sup> Difference not statistically significant (p $\geq 0.05$ ) for distant disease.
Wilkinson & Cameron 2004 <sup>40</sup>	SA	Cohort	SA CR	1980-1998	NS	Proportion of tumours $> 20$ mm	Chi-square	No statistically significant difference (p=0.57) in tumour size by residential location.

BS BreastScreen, CR Cancer Registry, CCR Central Cancer Registry CT Chemotherapy, NBCA National Breast Cancer Audit Database, NS not stated

1. National: all states/territories; NSW: New South Wales; Qld: Queensland; SA: South Australia; Vic: Victoria and WA Western Australia
2. Female invasive breast cancers cases
3. National Breast Cancer Audit Database covers about 60% of early (note 4) invasive female breast cancers diagnosed in Australia between 1998 and 2010.
4. Early disease defined as invasive tumours of  $\leq 50$ mm diameter with either impalpable or palpable but not fixed lymph nodes and no evidence for distant metastases.
5. Adjusted for age at diagnosis, diagnostic period, area disadvantage, annual surgeon caseload, treatment centre location and treatment-factors.
6. Adjusted for diagnostic period, referral source, tumour laterality, ovarian ablation and treatment centre location.
7. Classified as early ( $\leq 20$ mm size, no evidence of nodal involvement) or advanced ( $> 20$ mm size and/or positive nodal status, includes cases diagnosed due to metastatic disease)
8. Adjusted for age at diagnosis, diagnostic period, Indigenous status, socio-demographic factors and area-disadvantage.
9. Classified as localised (node-negative confined to breast tissue), regional (involves regional lymph nodes or adjacent tissues, includes locally advanced disease) or distant (spread to distant organs or lymph nodes, includes metastatic disease)
10. Adjusted for age at diagnosis, diagnostic period, area-disadvantage and country of birth

**Table 5.** Characteristics of included studies on diagnostic outcomes

Study	Location <sup>1</sup>	Design	Source	Period	Sample	Outcomes	Analysis	Results
Barratt <i>et al</i> 1997 <sup>51</sup>	National	Cross-sectional	Electronic white telephone directory	1996	2,935 randomly selected women, aged 30-69 years, no breast cancer history.	Self-reported screening mammography history	Chi-square	No statistically significant ( $p \geq 0.05$ ) differences in percentage of women aged 50-69 years ( $n=1,035$ ) who reported having a screening mammography by residential location.
Cockburn <i>et al</i> 1997 <sup>56</sup>	Vic	Cross-sectional (	Local media, community groups (in target rural area)	1995	180 women, aged 50-69 years, understood spoken English, no screening history 6 months pre-interview	Utilization of a screening mammography service	Logistic regression	50% of sample used service. No previous screening history, higher perceived breast cancer risk, lower education, intention to attend and knowledge of service location all significant predictors ( $p < 0.05$ ) of utilizing it after adjustment. <sup>2</sup>
Leung <i>et al</i> 2014 <sup>50</sup>	National	Longitudinal prospective survey	ALSWH	2001-2010	11,200 women, from 1946-1951 birth cohort, aged 50-55 years (2001)	Self-reported screening mammography history, rescreening (within last two years)	Chi-square, Logistic regression	No statistically significant ( $p \geq 0.05$ ) differences in screening rates by residential location after adjustment. <sup>3</sup> Non-metropolitan women had significantly ( $p < 0.001$ ) poorer adjusted access to screening services. They were 25-63% ( $p < 0.05$ ) more likely to have been rescreened than metropolitan women. <sup>3</sup>
Schofield <i>et al</i> 1994 <sup>54</sup>	Vic	Random sampling	Electoral lists (women from target area)	1988-1990	668 women, aged 50-69 years	Utilization of a single screening mammography service	Logistic regression	Women who lived within 10-20 km of the service 43% ( $p < 0.05$ ) less likely to have accessed it than those residing within 2km of it after adjustment. <sup>4</sup>
Siapush & Singh 2002 <sup>55</sup>	National	Multistage sampling	ANHS	1995	Subsample of 10,179 women, aged $\geq 18$ years	Self-reported screening mammography history, rescreening (within a year if aged $\geq 50$ -years)	Logistic regression	Non-metropolitan women 39% ( $p < 0.001$ ) more likely to report no screening mammography history and 20% ( $p < 0.05$ ) more likely to not have been rescreened than metropolitan women after adjustment. <sup>5</sup>
Sullivan <i>et al</i> 2003 <sup>52</sup>	WA	Data linkage	Disability Services database, WA CR, BS WA	1982-2000	380 women, aged 50-69 years, known intellectual disability, matched to CR and BS databases	Utilization of screening mammography service	Logistic regression	Non-metropolitan women 2 times ( $p < 0.05$ ) more likely to have utilized the free screening mammography programme than metropolitan women after adjustment. <sup>6</sup>
Weber <i>et al</i> 2014 <sup>53</sup>	NSW	Cohort	Medicare Australia	2006-2010	101,063 women (77,139 Australian,	Self-reported mammography	Poisson regression	No statistically significant differences in screening rates among immigrant women

Study	Location <sup>1</sup>	Design	Source	Period	Sample	Outcomes	Analysis	Results
					23,024 immigrant), aged $\geq 50$ years, included in the 45 and Up Study	screening		but among Australian-born women, those from non-metropolitan areas were 2% more likely to have utilized the national screening program than metropolitan women after adjustment. <sup>7</sup>
Hughes <i>et al</i> 2014 <sup>57</sup>	WA	Retrospective cohort	BS WA	1999-2008	Number unknown, aged 50-67 years, initial screen (BS WA)	Rescreening (within 27 months of initial screen) <sup>8</sup>	Not stated	No statistically significant differences in rescreening rates by residential location.
O'Byrne <i>et al</i> 2000 <sup>58</sup>	Vic	Retrospective cohort	BS Vic	1995-1996	121,889 women, aged 50-69 years, initial screen (BS Victoria), invited for a routine biennial screening mammogram	Rescreening (within 27 months of initial screen) <sup>8</sup>	Logistic regression	Non-metropolitan women were 13-24% more likely to return for routine rescreening than metropolitan women after adjustment. <sup>9</sup>

ALSWH Australian Longitudinal Study on Women's Health, ANHS Australian National Health Survey, BS BreastScreen, CR Cancer Registry

1. National: all states/territories; NSW: New South Wales; Vic: Victoria and WA Western Australia
2. Adjusted for screening history, perceived breast cancer risk, education, breast-cancer screening awareness, perceived barriers, knowledge of service location, intention to attend, social influences, socio-demographic factors and access issues
3. Adjusted for time and interaction between time and residential area
4. Adjusted for intention to attend, experience of, perceived susceptibility to, concerns and knowledge about breast cancer, screening concerns, other preventive behaviour, health related character traits, access and socio-demographic factors.
5. Adjusted for age, socio-demographic factors, area-disadvantage and country of birth
6. Adjusted for age, marital status, institutional care, level of intellectual disability and medical history
7. Adjusted for age, family cancer history, socio-demographic factors and hormone replacement therapy; stratified by place of birth
8. Screening interval of 27 months used of recommended 24 months to allow for potential delays in screening availability and data transfer.
9. Adjusted for age, Indigenous status, language spoken at home, area-disadvantage, hormone replacement therapy, family breast cancer history and characteristics related to initial screening (recruitment method, type of service attended, symptoms and assessment status)

**Table 6.** Characteristics of included studies on treatment outcomes

Study	Location <sup>1</sup>	Design	Source	Period	Sample <sup>2</sup>	Outcomes	Analysis	Results
Adelson <i>et al</i> 1997 <sup>62</sup>	NSW	Retrospective data linkage	NSW CCR, ISC	1991-1992	4,038, known spread disease, BC-surgery	BCS versus MST	Chi-square, Logistic regression	Non-metropolitan women (versus metropolitan) 2 times more likely to have MST (localized disease); adjusted difference not statistically significant ( $p \geq 0.05$ ) for metastatic disease. <sup>3</sup>
Azzopardi <i>et al</i> 2014 <sup>61</sup>	National	Clinical audit	NBCA database <sup>4</sup>	1998-2012	21,643, early disease <sup>5</sup>	BCS versus MST, adjuvant RT (yes/no)	Chi-square (surgical type), Logistic regression (RT)	Proportions of BCS decreased and MST increased significantly ( $p < 0.001$ ) with increasing remoteness. Women from areas lacking a RT facility (versus RT facility present) and non-metropolitan women (versus metropolitan) 23% ( $p < 0.001$ ) and 20% ( $p = 0.002$ ) less likely respectively to have RT after adjustment. <sup>6</sup>
Bell <i>et al</i> 2012 <sup>73</sup>	Vic	Longitudinal cohort <sup>7</sup>	Health & Wellbeing After BC study	2004-2006	366, prior unilateral MST, known BR status	BR (yes/no)	Logistic Regression	Non-metropolitan women 73% ( $p < 0.001$ ) less likely to have BR than metropolitan women after adjustment. <sup>8</sup>
Budden <i>et al</i> 2014 <sup>78</sup>	Qld	Cross-sectional	3 regional locations	NS	104, Stage 1-IIA, MST or BCS/RT	Satisfaction treatment decision	Chi-square	90% women satisfied with decision process, 94% with outcome and 69% offered treatment choices.
Campbell <i>et al</i> 2006 <sup>76</sup>	National (not Tas)	Cross-sectional	State Cancer Registries	1997	544, early disease	Systematic SBN care (yes/no)	Chi-square	No differences in receipt of systematic SBN care ( $p = 0.280$ ) by residential location.
Craft <i>et al</i> 1997 <sup>68</sup>	National	Retrospective survey	Medicare Australia	1993	4,683, had BC-surgery (on MBS)	Frequency (BCS, AS)	Chi-square	Non-metropolitan women (versus metropolitan) had lower BCS (34% versus 42%, $p < 0.001$ ); no differences in AS rates by residential location.
Eley <i>et al</i> 2008 <sup>77</sup>	Qld	Cross-sectional	Non-metropolitan, offered BCN support	2005-2006	51, aged 38-79 years, post active treatment	Interactions with BCN	Frequencies	BCN valuable source of treatment-related information (86% sampled women) and help during decision-process (71%).
Fox <i>et al</i> 2013 <sup>46</sup>	NSW	Medical chart reviews	Records (4 medical centres)	2008-2011	400, non-metastatic, had adjuvant CT	Delays (consultation medical oncologist, start CT), CT finish	Chi-square, Mann-Whitney	Non-metropolitan women (versus metropolitan) significantly ( $p < 0.001$ ) more likely to have longer consultation and CT start delays and to complete CT course (90% versus 82%, $p = 0.020$ ).
Hall & Holman 2003 <sup>74</sup>	WA	Cohort	WA Record Linkage Project	1991-2000	7,303, prior MST or BCS	BR (yes/no)	Chi-square, Cox regression	Non-metropolitan women (versus metropolitan) 46% less likely to have BR, but adjusted difference not statistically significant. <sup>9</sup>
Hall <i>et al</i> 2004b <sup>69</sup>	WA	Cohort	WA Record Linkage Project	1991-2000	7,304, had BCS or MST	BCS versus MST	Chi-square, Logistic regression	Non-metropolitan women (versus metropolitan) less likely to have BCS, but adjusted difference not statistically significant. <sup>9</sup>

Study	Location <sup>1</sup>	Design	Source	Period	Sample <sup>2</sup>	Outcomes	Analysis	Results
Hill <i>et al</i> 1994 <sup>70</sup>	Vic	Population-based survey	Vic CR	1990	856, had BC-surgery, treating surgeon sent questionnaire (patterns of clinical care)	BCS, adjuvant RT, CT, HT (all yes/no), Referral (% patients)	Chi-square, ANOVA, Student t-test	Non-metropolitan women (versus metropolitan) less likely to have BCS (33% versus 46% metropolitan); no differences in adjuvant therapies (no quantitative data) or medical oncologist referrals. 60 women who saw metropolitan (versus non-metropolitan surgeons) more likely to have BCS (48% versus 27%). Non-metropolitan surgeons less likely to refer patients to radiation oncologists (28% versus 43%).
Kok <i>et al</i> 2006 <sup>45</sup>	Vic	Retrospective cohort	BS Vic	1993-2000	5,294 diagnosed through screening	BCS versus MST, adjuvant RT (yes/no)	Chi-square, Logistic regression	Non-metropolitan women (versus metropolitan) significantly ( $p<0.001$ ) less likely to have BCS (58%) and RT after BCS (27%) after adjustment. <sup>10</sup>
Koshy <i>et al</i> 2005 <sup>63</sup>	NSW, ACT	Prospective audit	Pathology reports, medical charts, clinicians	1997-2002	1,069, non-metastatic, had BC-surgery	BCS versus MST	Chi-square	Non-metropolitan women more likely to choose MST (23% versus 15% metropolitan) but difference not statistically significant ( $p=0.09$ ).
Kricker <i>et al</i> 2001 <sup>64</sup>	NSW	Data linkage	NSW CCR, ISC	1992, 1995	2,020 or 2,883 had BCS or MST	BCS versus MST, AS (yes/no)	Logistic regression	Non-metropolitan women (versus metropolitan) more likely to have a MST but adjusted difference not statistically significant ( $p\geq 0.05$ ); no statistically significant differences in AS rates by residential location after adjustment. <sup>11</sup>
Lai <i>et al</i> 2007 <sup>71</sup>	WA	Data linkage	WA Data Linkage System	1995-1999	2,703, had BCS or MST	Unplanned hospital readmission <sup>12</sup>	Survival model (multiple events/subject)	Metropolitan women (versus non-metropolitan) 10% ( $p<0.05$ ) lower unplanned readmission rates after adjustment. <sup>13</sup>
Martin <i>et al</i> 2006 <sup>65</sup>	WA	Data linkage	WA Data Linkage System	1990-1999	2,713, one primary BC	BCS versus MST	Classification trees, Logistic regression	Non-metropolitan women (versus metropolitan) significantly ( $p<0.001$ ) more likely to choose MST after adjustment. <sup>14</sup>
Mastaglia & Kristjanson 2001 <sup>66</sup>	WA	Cross-sectional	WA CR	1996-1997	160, Stage I-II	BCS versus MRM	Chi-square	Non-metropolitan women significantly ( $p<0.001$ ) more likely to choose MRM than BCS (71% versus 36% metropolitan).
Mitchell <i>et</i>	WA	Cohort	WA CR	1999	899 (492 BCS,	BCS, adjuvant	Chi-square	Non-metropolitan women (versus metropolitan)

28



Study	Location <sup>1</sup>	Design	Source	Period	Sample <sup>2</sup>	Outcomes	Analysis	Results
<i>al</i> 2006 <sup>36</sup>					692 HR+) histologically verified	RT, CT, HT, High (>=20 cases/year) caseload surgeon (all yes/no)		less likely to have BCS (42% versus 59%, p<0.001), RT (43% versus 55%, p=0.004), HT (64% versus 70%, if HR +, 75% versus 85%, p=0.003-0006) or high caseload surgical care (70% versus 86%, p<0.001); no statistically significant (p≥0.448) differences in post BCS- RT rates or CT.
Morris <i>et al</i> 2012 <sup>72</sup>	National	Audit	NBCA, NSW CCR, Vic CR, MBS	2008 (last 6 months)	1,334 (NBCA), 1,359 (NSW), 1,267 (Vic), ≤30mm size tumours	SNB (yes/no)	Two proportion z-tests (pooled)	Non-metropolitan women less likely to have a SNB among NCBA (66% versus 82% metropolitan), NSW (76% versus 86%) and Victorian (65% versus 81%) cohorts.
Ristevski <i>et al</i> 2012 <sup>79</sup>	Vic	Cross-sectional	Recruited by surgeons and nurses (one regional area)	NS	70, first primary early disease <sup>5</sup> , ≥six weeks post-surgery	Satisfaction, Referral (medical/ service type)	Descriptive, Fischer's exact test	97% of sample satisfied with treatment decision process regardless of surgical procedure. 42% referred to other health professionals/service before surgery.
Roder <i>et al</i> 2013a <sup>42</sup>	National	Non-representative sample	NBCA database <sup>4</sup>	1998-2010	30,299, early disease <sup>5</sup> , residential postcodes noted	BCS versus MST, adjuvant RT, CT, Low (<=10 cases/year) caseload surgeon (all yes/no)	Chi-square, Logistic regression	Non-metropolitan women (versus metropolitan) significantly less likely (p≤0.05) to have BCS (6%) or RT after BCS (7%) but more likely to have CT (10%), care at regional (4-31% versus major city) or remote centres (7 times) and low caseload care (9%, p=0.074) after adjustment. <sup>15</sup>
Roder <i>et al</i> 2013b <sup>26</sup>	National	Non-representative sample	NBCA database <sup>4</sup>	1998-2010	30,299, early disease <sup>5</sup> , residential postcodes noted	BCS versus MST, Low (<=10 cases/year) caseload surgeon (yes/no)	Chi-square, Logistic regression	Non-metropolitan women (versus metropolitan) more likely to have MST (5-9 times, adjusted <sup>16</sup> ); and in bivariate analysis (p<0.001) low caseload surgical care or care outside major cities. Low surgical caseload significant (p<0.05) predictor of treatment outside major cities and higher MST.
Roder <i>et al</i> 2013c <sup>75</sup>	National	Non-representative sample	NBCA database <sup>4</sup>	1998-2010	12,207, early disease <sup>5</sup> , prior MST, residential postcodes noted	IBR versus delayed or no BR after MST	Chi-square, Logistic regression	Non-metropolitan women (versus metropolitan) 13% less likely to have IBR (bivariate, p=0.043). Metropolitan rather than inner regional treatment centre and high (≥11 cases/year) surgical caseload significant (p<0.001) predictors of IBR after multivariate adjustment. <sup>17</sup>
Roder <i>et al</i> 2012b <sup>87</sup>	National	Non-representative sample	NBCA database <sup>4</sup>	1998-2005	36,775, early disease <sup>5</sup> , residential	Declining recommended treatment (yes/no)	Chi-square, Logistic regression	Percentage declining a treatment increased with remoteness of treatment centre (3% major cities, 5-9% outside major cities, p<0.001). Non-

Study	Location <sup>1</sup>	Design	Source	Period	Sample <sup>2</sup>	Outcomes	Analysis	Results
					postcodes noted			metropolitan centres and low surgical caseload ( $\leq 20$ cases/year) significant predictors of women declining BCS or RT ( $p < 0.001$ ); MST, AS or CT (caseload only, $p \leq 0.003$ ); HT (location, $p < 0.001$ ). <sup>18</sup>
Thompson <i>et al</i> 2008 <sup>67</sup>	Qld	Data linkage	Qld CR, Qld HAPDC	2004, 2004-2005 HAPDC record	1,274, early disease <sup>5</sup> , could be linked to medical records	MST, AS	Chi-square, Logistic regression	Non-metropolitan women (versus metropolitan) 2 times more likely to have MST, no statistically significant ( $p = 0.196$ ) differences in AS rates after adjustment. <sup>19</sup>
Tulloh & Goldsworthy 1997 <sup>80</sup>	Vic	Medical chart reviews	Single rural centre	1992-1995	28 women	BCS versus MST	Descriptive	Rural setting no impediment to BCS (68%) or a multidisciplinary approach (93%).

AS axillary surgery (lymph nodes), BC Breast Cancer, BCN breast cancer nurse, BCS breast conservation surgery, BR breast reconstruction, BS BreastScreen, CR Cancer Registry, CCR Central Cancer Registry, CT chemotherapy, HAPDC Hospital Admitted Patient Data Collection, HR hormone receptor, HT hormone therapy, IBR immediate breast reconstruction, ISC Inpatient Statistics Collection, MBS Medical Benefits Schedule, MRM modified radical mastectomy, MST mastectomy, NBCA National Breast Cancer Audit, SBN specialist breast nurse, SE South-East, SNB sentinel node biopsy, RT adjuvant radiotherapy

1. National: all states/territories; ACT: Australian Capital Territory; NSW: New South Wales; Qld: Queensland; SA: South Australia; Vic: Victoria and WA Western Australia
2. Female invasive breast cancers cases
3. Adjusted for age at diagnosis, spread of disease, interaction between degree of spread and residential location.
4. National Breast Cancer Audit Database covers about 60% of early invasive female breast cancers diagnosed in Australia between 1998 and 2010.
5. Early disease defined as invasive tumours of  $\leq 50$ mm diameter with either impalpable or palpable but not fixed lymph nodes and no evidence for distant metastases.
6. Adjusted for presence/absence of a radiotherapy facility in the same postcode as residential location of patient.
7. A final questionnaire completed up to 3 years post diagnosis.
8. Adjusted for age at diagnosis, socio-demographic factors and radiotherapy.
9. Adjusted for age at diagnosis, diagnostic period, Indigenous status, socio-demographic factors, comorbidities, area-disadvantage and hospital related factors.
10. Adjusted for age at diagnosis, diagnostic period, language spoken at home, clinical features, area-disadvantage, symptom status, cancer history and surgical caseload
11. Adjusted for age at diagnosis, area-disadvantage and country of birth.
12. Defined as within 42 days from initial surgery
13. Adjusted for age at diagnosis, clinical features, initial surgical procedure, health insurance status, country of birth and interactions between these variables.
14. Adjusted for age at diagnosis, clinical features, Indigenous status, socio-demographic factors and country of birth.
15. Adjusted for diagnostic period, area disadvantage and treatment centre location.
16. Adjusted for tumour size
17. Adjusted for age and year at diagnosis, clinical features, area-disadvantage, referral source, health insurance status, surgeon caseload and treatment-factors.
18. Adjusted for age at diagnosis, clinical features, treatment centre location, private health insurance status and surgeon caseload
19. Adjusted for age at diagnosis, tumour size, comorbidities, hospital type and surgical caseload.



References

1. Ferlay J, Soerjomataram I, Dikshit R, et al. Cancer incidence and mortality worldwide: Sources, methods and major patterns in GLOBOCAN 2012. *Int J Cancer* 2015;136(5):E359-E86.

2. AIHW. Australian Cancer Incidence and Mortality (ACIM) books Canberra: Australian Institute of Health and Welfare; 2014 [Available from: <http://www.aihw.gov.au/acim-books> accessed 23 January 2015].

3. Youlten DR, Cramb SM, Dunn NA, et al. The descriptive epidemiology of female breast cancer: an international comparison of screening, incidence, survival and mortality. *Cancer Epidemiol* 2012;36(3):237-48.

4. McKenzie F, Ives A, Jeffreys M. Socio-economic inequalities in survival from screen-detected breast cancer in South West England: population-based cohort study. *Eur J Public Health* 2012;22(3):418-22.

5. Panagopoulou P, Gogas H, Dessypris N, et al. Survival from breast cancer in relation to access to tertiary healthcare, body mass index, tumor characteristics and treatment: a Hellenic Cooperative Oncology Group (HeCOG) study. *Eur J Epidemiol* 2012;27(11):857-66.

6. Sprague BL, Trentham-Dietz A, Gangnon RE, et al. Socioeconomic status and survival after an invasive breast cancer diagnosis. *Cancer* 2011;117(7):1542-51.

7. Leung J, McKenzie S, Martin J, et al. Effect of rurality on screening for breast cancer: a systematic review and meta-analysis comparing mammography. *Rural Remote Health* 2014;14(2):2730.

8. Meilleur A, Subramanian SV, Plascak JJ, et al. Rural Residence and Cancer Outcomes in the United States: Issues and Challenges. *Cancer Epidemiology Biomarkers & Prevention* 2013;22(10):1657-67.

9. Nguyen-Pham S, Leung J, McLaughlin D. Disparities in breast cancer stage at diagnosis in urban and rural adult women: a systematic review and meta-analysis. *Ann Epidemiol* 2014;24(3):228-35.

10. Coleman MP, Forman D, Bryant H, et al. Cancer survival in Australia, Canada, Denmark, Norway, Sweden, and the UK, 1995-2007 (the International Cancer Benchmarking Partnership): an analysis of population-based cancer registry data. *Lancet* 2011;377(9760):127-38.

11. AIHW. Breast cancer in Australia: an overview Cancer series no. 71. Cat. no. CAN 67: Australian Institute of Health & Welfare, Canberra, 2012.

12. AIHW. Cancer survival and prevalence in Australia: period estimates from 1982 to 2010. Cat. no. CAN 65: Australian Institute of Health & Welfare, Canberra, 2012.

13. Yu XQ, Luo Q, Kahn C, et al. Temporal trends show improved breast cancer survival in Australia but widening urban-rural differences. *The Breast*;24(4):524-27.

14. Underhill C, Bartel R, Goldstein D, et al. Mapping oncology services in regional and rural Australia. *Aust J Rural Health* 2009;17(6):321-29.

15. Smith T. A long way from home: Access to cancer care for rural Australians. *Radiography* 2012;18(1):38-42.

16. ABS. Regional Population Growth, Australia, 2012-13 Canberra: Australian Bureau of Statistics (ABS) 2013 [Available from: <http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/3218.0Main+Features12012-13?OpenDocument> accessed 24 February 2015].

17. AIHW. Rural, regional and remote health: a study on mortality (2nd edition) Rural Health Series no.8. Cat. no. PHE 95: Australian Institute of Health & Welfare, Canberra, 2007.

18. Murphy C, Sabesan S, Steer C, et al. Oncology service initiatives and research in regional Australia. *Aust J Rural Health* 2015;23(1):40-48.
19. Youl PH, Dasgupta P, Youlden D, et al. A systematic review of inequalities in psychosocial outcomes for women with breast cancer according to residential location and Indigenous status in Australia. *Psychooncology* 2016;25(10):1157-67.
20. Liberati A, Altman DG, Tetzlaff J, et al. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: explanation and elaboration. *BMJ* 2009;339:b2700.
21. University of the Sunshine Coast. Answering a Good Question (PICO) 2015 [Available from: <http://www.usc.edu/hsc/ebnet/ebframe/PICO.htm#C> accessed 8 May 2015].
22. Wells G, Shea B, O'Connell D, et al. The Newcastle-Ottawa Scale (NOS) for assessing the quality of non-randomised studies in meta-analyses 2013 [Available from: [http://www.ohri.ca/programs/clinical\\_epidemiology/oxford.asp](http://www.ohri.ca/programs/clinical_epidemiology/oxford.asp) accessed 20 February 2015].
23. Higgins JPT, Green S, editors. *Cochrane handbook for systematic reviews of interventions version 5.1.0, [updated March 2011]* Available from [www.cochrane-handbook.org](http://www.cochrane-handbook.org). : The Cochrane Collaboration 2011.
24. NHMRC. NHMRC levels of evidence and grades for recommendations for guideline developers: National Health and Medical Research Council, Canberra, 2009.
25. University of York. Systematic Reviews, CRD's guidance for undertaking reviews in health care. Available from <http://www.york.ac.uk/crd/guidance/>. University of York: Centre for Reviews and Dissemination, 2008.
26. Roder D, Zorbas H, Kollias J, et al. Factors predictive of treatment by Australian breast surgeons of invasive female breast cancer by mastectomy rather than breast conserving surgery. *Asian Pac J Cancer Prev* 2013;14(1):539-45.
27. AIHW. Rural, regional and remote health: A guide to remoteness classifications. Cat. No. PHE 53. Canberra: Australian Institute of Health and Welfare, 2004.
28. AIHW. Cancer survival and prevalence in Australia: Period estimates from 1982 to 2010. *Asia Pac J Clin Oncol* 2013;9(1):29-39.
29. Roder D, Webster F, Zorbas H, et al. Breast screening and breast cancer survival in Aboriginal and Torres Strait Islander women of Australia. *Asian Pacific journal of cancer prevention : APJCP* 2012;13(1):147-55.
30. Bonett A, Dorsch M, Roder D, et al. Infiltrating ductal carcinoma of the breast in South Australia. Implications of trends in tumour diameter, nodal status and case-survival rates for cancer control. *Med J Aust* 1990;152(1):19-23.
31. Chen TY, Morrell S, Thomson W, et al. Survival from breast, colon, lung, ovarian and rectal cancer by geographical remoteness in New South Wales, Australia, 2000-2008. *Aust J Rural Health* 2015;23(1):49-56.
32. Clayforth C, Fritschi L, McEvoy SP, et al. Five-year survival from breast cancer in Western Australia over a decade. *Breast* 2007;16(4):375-81.
33. Cramb SM, Mengersen KL, Turrell G, et al. Spatial inequalities in colorectal and breast cancer survival: premature deaths and associated factors. *Health Place* 2012;18(6):1412-21.
34. Dasgupta P, Baade PD, Aitken JF, et al. Multilevel determinants of breast cancer survival: association with geographic remoteness and area-level socioeconomic disadvantage. *Breast Cancer Res Treat* 2012;132(2):701-10.

35. Hall S, Holman CD, Sheiner H, et al. The influence of socio-economic and locational disadvantage on survival after a diagnosis of lung or breast cancer in Western Australia. *J Health Serv Res Policy* 2004;9 Suppl 2:10-6.

36. Mitchell KJ, Fritschi L, Reid A, et al. Rural-urban differences in the presentation, management and survival of breast cancer in Western Australia. *Breast* 2006;15(6):769-76.

37. Spilsbury K, Semmens JB, Saunders CM, et al. Long-term survival outcomes following breast cancer surgery in Western Australia. *ANZ J Surg* 2005;75(8):625-30.

38. Supramaniam R, Gibberd A, Dillon A, et al. Increasing rates of surgical treatment and preventing comorbidities may increase breast cancer survival for Aboriginal women. *BMC Cancer* 2014;14(1).

39. Tracey E, Roder D, Zorbas H, et al. Survival and degree of spread for female breast cancers in New South Wales from 1980 to 2003: implications for cancer control. *Cancer Causes Control* 2008;19(10):1121-30.

40. Wilkinson D, Cameron K. Cancer and cancer risk in South Australia: what evidence for a rural-urban health differential? *Aust J Rural Health* 2004;12(2):61-66.

41. Taylor R. Breast cancer five-year survival, by New South Wales regions, 1980 to 1991. *Aust N Z J Public Health* 1997;21(2):206-10.

42. Roder D, Zorbas H, Kollias J, et al. Risk factors for poorer breast cancer outcomes in residents of remote areas of Australia. *Asian Pac J Cancer Prev* 2013;14(1):547-52.

43. Roder D, Zorbas HM, Kollias J, et al. Analysing risk factors for poorer breast cancer outcomes in residents of lower socioeconomic areas of Australia. *Aust Health Rev* 2014;38(2):134-41.

44. Baade PD, Turrell G, Aitken JF. Geographic remoteness, area-level socio-economic disadvantage and advanced breast cancer: a cross-sectional, multilevel study. *J Epidemiol Community Health* 2011;65(11):1037-43.

45. Kok DL, Chang JH, Erbas B, et al. Urban-rural differences in the management of screen-detected invasive breast cancer and ductal carcinoma in situ in victoria. *ANZ J Surg* 2006;76(11):996-1001.

46. Fox PN, Chatfield MD, Beith JM, et al. Factors delaying chemotherapy for breast cancer in four urban and rural oncology units. *ANZ J Surg* 2013;83(7-8):533-8.

47. Lord SJ, Marinovich ML, Patterson JA, et al. Incidence of metastatic breast cancer in an Australian population-based cohort of women with non-metastatic breast cancer at diagnosis. *Med J Aust* 2012;196(11):688-92.

48. Luke C, Nguyen AM, Priest K, et al. Female breast cancers are getting smaller, but socio-demographic differences remain. *Aust N Z J Public Health* 2004;28(4):312-6.

49. AIHW. BreastScreen Australia: monitoring report 2011-2012. Cat. no. CAN 83 Australian Institute of Health and Welfare, Canberra, 2014.

50. Leung J, McKenzie S, Martin J, et al. Longitudinal patterns of breast cancer screening: mammography, clinical, and breast self-examinations in a rural and urban setting. *Womens Health Issues* 2014;24(1):e139-46.

51. Barratt AL, Cockburn J, Redman S, et al. Mammographic screening: results from the 1996 National Breast Health Survey. *Med J Aust* 1997;167(10):521-4.

52. Sullivan SG, Glasson EJ, Hussain R, et al. Breast cancer and the uptake of mammography screening services by women with intellectual disabilities. *Prev Med* 2003;37(5):507-12.

53. Weber MF, Chiew M, Feletto E, et al. Cancer screening among immigrants living in urban and regional Australia: Results from the 45 and up study. *Int J Environ Res Public Health* 2014;11(8):8251-66.

54. Schofield PE, Cockburn J, Hill DJ, et al. Encouraging attendance at a screening mammography programme: determinants of response to different recruitment strategies. *J Med Screen* 1994;1(3):144-9.
55. Siahpush M, Singh GK. Sociodemographic variations in breast cancer screening behavior among Australian women: results from the 1995 National Health Survey. *Prev Med* 2002;35(2):174-80.
56. Cockburn J, Sutherland M, Cappiello M, et al. Predictors of attendance at a relocatable mammography service for rural women. *Aust N Z J Public Health* 1997;21(7):739-42.
57. Hughes JP, Jose DC, Tuch GH, et al. Is Step Down Assessment of screen-detected lesions as safe as workup at a Metropolitan Assessment Centre? *Aust N Z J Public Health* 2014;38(1):44-48.
58. O'Byrne AM, Kavanagh AM, Ugoni A, et al. Predictors of non-attendance for second round mammography in an Australian mammographic screening programme. *J Med Screen* 2000;7(4):190-4.
59. NBCC. National Breast Cancer Centre (NBCC). Clinical practice guidelines for management of early breast cancer, 2nd ed. : Canberra: Commonwealth of Australia, 2001.
60. NBOCC. Guide for women with secondary breast cancer, : National Breast and Ovarian Cancer Centre (NBOCC). Surry Hills, NSW, 2010.
61. Azzopardi J, Walsh D, Chong C, et al. Impact of geographic location on surgical outcomes of women with breast cancer. *ANZ J Surg* 2014;84(10):735-39.
62. Adelson P, Lim K, Churches T, et al. Surgical treatment of breast cancer in New South Wales 1991, 1992. *Aust N Z J Surg* 1997;67(1):9-14.
63. Koshy A, Buckingham JM, Zhang Y, et al. Surgical management of invasive breast cancer: a 5-year prospective study of treatment in the Australian Capital Territory and South-Eastern New South Wales. *ANZ J Surg* 2005;75(9):757-61.
64. Kricker A, Haskill J, Armstrong BK. Breast conservation, mastectomy and axillary surgery in New South Wales women in 1992 and 1995. *Br J Cancer* 2001;85(5):668-73.
65. Martin MA, Meyricke R, O'Neill T, et al. Mastectomy or breast conserving surgery? Factors affecting type of surgical treatment for breast cancer - A classification tree approach. *BMC Cancer* 2006;6.
66. Mastaglia B, Kristjanson LJ. Factors influencing women's decisions for choice of surgery for Stage I and Stage II breast cancer in Western Australia. *J Adv Nurs* 2001;35(6):836-47.
67. Thompson B, Baade P, Coory M, et al. Patterns of surgical treatment for women diagnosed with early breast cancer in Queensland. *Ann Surg Oncol* 2008;15(2):443-51.
68. Craft PS, Primrose JG, Lindner JA, et al. Surgical management of breast cancer in Australian women in 1993: analysis of Medicare statistics. *Med J Aust* 1997;166(12):626-9.
69. Hall SE, Holman CD, Hendrie DV, et al. Unequal access to breast-conserving surgery in Western Australia 1982-2000. *ANZ J Surg* 2004;74(6):413-9.
70. Hill DJ, White VM, Giles GG, et al. Changes in the investigation and management of primary operable breast cancer in Victoria. *Med J Aust* 1994;161(2):110-18.
71. Lai JK, Martin MA, Meyricke R, et al. Factors associated with short-term hospital readmission rates for breast cancer patients in Western Australia: an observational study. *J Am Coll Surg* 2007;204(2):193-200.
72. Morris T, Wetzig N, Sinclair S, et al. Evaluation of implementation of sentinel node biopsy in Australia. *ANZ J Surg* 2012;82(7-8):541-7.

73. Bell RJ, Robinson PJ, Fradkin P, et al. Breast reconstruction following mastectomy for invasive breast cancer is strongly influenced by demographic factors in women in Victoria, Australia. *Breast* 2012;21(3):394-400.

74. Hall SE, Holman CD. Inequalities in breast cancer reconstructive surgery according to social and locational status in Western Australia. *Eur J Surg Oncol* 2003;29(6):519-25.

75. Roder D, Zorbas H, Kollias J, et al. Factors predictive of immediate breast reconstruction following mastectomy for invasive breast cancer in Australia. *Breast* 2013;22(6):1220-5.

76. Campbell D, Khan A, Rankin N, et al. Are specialist breast nurses available to Australian women with breast cancer? *Cancer Nurs* 2006;29(1):43-8.

77. Eley RM, Rogers-Clark C, Murray K. The value of a breast care nurse in supporting rural and remote cancer patients in Queensland. *Cancer Nurs* 2008;31(6):E10-8.

78. Budden LM, Hayes BA, Buettner PG. Women's decision satisfaction and psychological distress following early breast cancer treatment: a treatment decision support role for nurses. *Int J Nurs Pract* 2014;20(1):8-16.

79. Ristevski E, Regan M, Birks D, et al. Communicating about breast cancer: rural women's experience of interacting with their surgeon. *Aust J Rural Health* 2012;20(1):22-8.

80. Tulloh BR, Goldsworthy ME. Breast cancer management: a rural perspective. *Med J Aust* 1997;166(1):26-9.

81. Albornoz CR, Cordeiro PG, Hishon L, et al. A nationwide analysis of the relationship between hospital volume and outcome for autologous breast reconstruction. *Plast Reconstr Surg* 2013;132(2):192e-200e.

82. Gentil J, Dabakuyo TS, Ouedraogo S, et al. For patients with breast cancer, geographic and social disparities are independent determinants of access to specialized surgeons. A eleven-year population-based multilevel analysis. *BMC Cancer* 2012;12:351.

83. Kong AL, Yen TW, Pezzin LE, et al. Socioeconomic and racial differences in treatment for breast cancer at a low-volume hospital. *Ann Surg Oncol* 2011;18(11):3220-7.

84. Gooiker GA, van Gijn W, Post PN, et al. A systematic review and meta-analysis of the volume-outcome relationship in the surgical treatment of breast cancer. Are breast cancer patients better off with a high volume provider? *European Journal of Surgical Oncology (EJSO)* 2010;36(Supplement 1):S27-S35.

85. Ess S, Joerger M, Frick H, et al. Predictors of state-of-the-art management of early breast cancer in Switzerland. *Ann Oncol* 2011;22(3):618-24.

86. Hershman DL, Richards CA, Kalinsky K, et al. Influence of health insurance, hospital factors and physician volume on receipt of immediate post-mastectomy reconstruction in women with invasive and non-invasive breast cancer. *Breast Cancer Res Treat* 2012;136(2):535-45.

87. Roder DM, de Silva P, Zorbas HN, et al. Adherence to recommended treatments for early invasive breast cancer: decisions of women attending surgeons in the breast cancer audit of Australia and New Zealand. *Asian Pac J Cancer Prev* 2012;13(4):1675-82.

88. NBOCC. Recommendations for follow-up of women with early breast cancer: National Breast and Ovarian Cancer Centre, (NBOCC): Surry Hills, 2010.

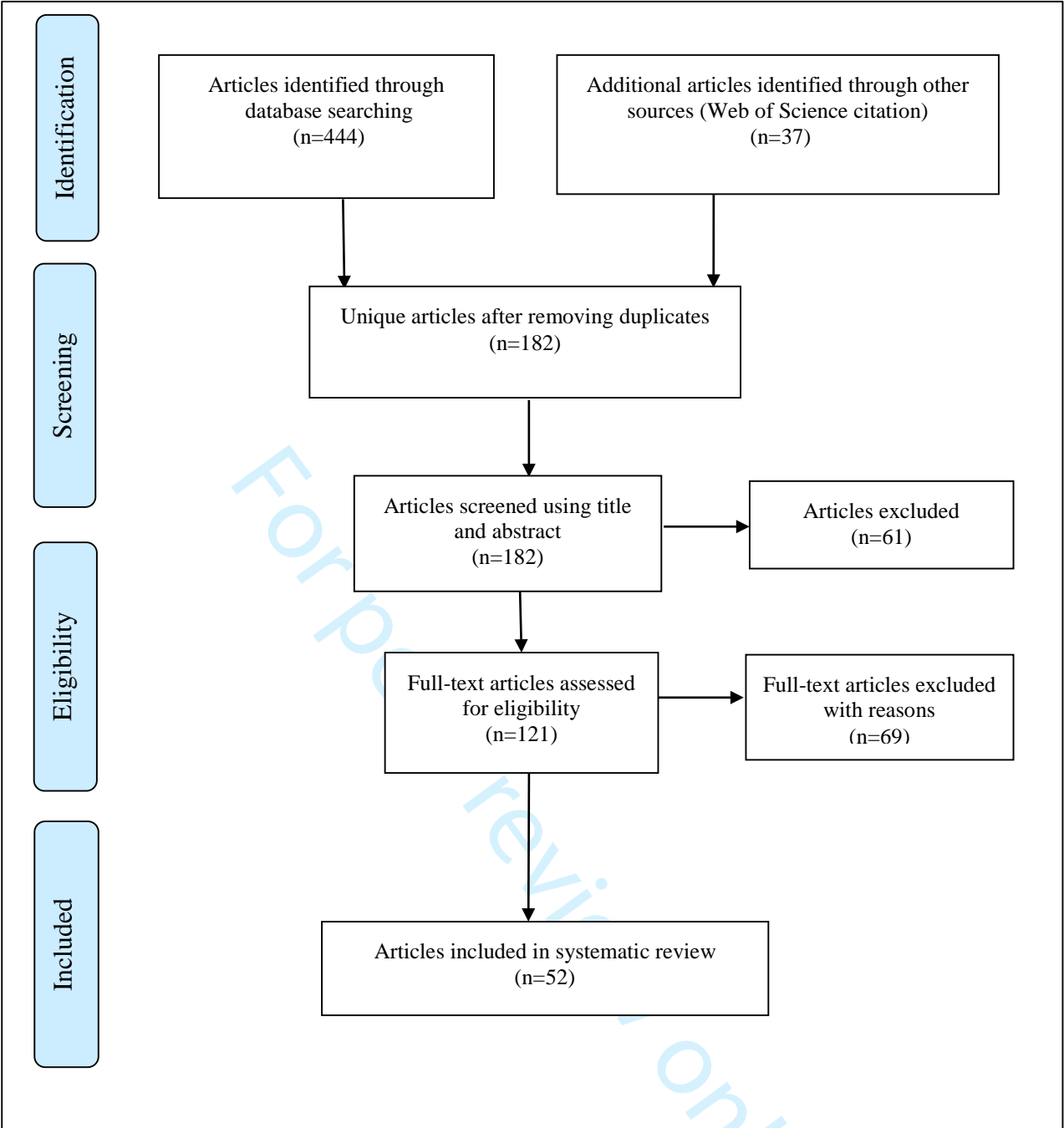
89. Lauby-Secretan B, Scoccianti C, Loomis D, et al. Breast-cancer screening--viewpoint of the IARC Working Group. *N Engl J Med* 2015;372(24):2353-8.

90. Prades J, Remue E, van Hoof E, et al. Is it worth reorganising cancer services on the basis of multidisciplinary teams (MDTs)? A systematic review of the objectives and organisation of MDTs and their impact on patient outcomes. *Health Policy* 2015;119(4):464-74.



91. NBOCC. Recommendations for the management of early breast cancer in women with an identified BRCA1 or BRCA2 gene mutation or at high risk of a gene mutation. : National Breast and Ovarian Cancer Centre, (NBOCC): Surry Hills, 2014.
92. NBOCC. Recommendations for use of Sentinel node biopsy in early (operable) breast cancer National Breast and Ovarian Cancer Centre, (NBOCC): Surry Hills, 2008.
93. RANZCR. Planning for the Best: Tripartite National Strategic Plan for Radiation Oncology 2012-2022, version 1: The Royal Australian and New Zealand College of Radiologists, Sydney, Australia, 2012.
94. Lam J, Cook T, Foster S, et al. Examining Determinants of Radiotherapy Access: Do Cost and Radiotherapy Inconvenience Affect Uptake of Breast-conserving Treatment for Early Breast Cancer? *Clin Oncol (R Coll Radiol)* 2015;27(8):465-71.
95. RANZCR. Radiation Therapy Waiting Times Sydney, Australia: Faculty of Radiation Oncology, The Royal Australian and New Zealand College of Radiologists (RANZCR); 2015 [Available from: <http://www.ranzcr.edu.au/about/faculty-of-radiation-oncology/faculty-initiatives/radiation-therapy-waiting-times> accessed 20 June 2015.
96. Yu XQ, Luo Q, Kahn C, et al. Temporal trends show improved breast cancer survival in Australia but widening urban–rural differences. *The Breast* 2015;24(4):524-27.
97. Olson RA, Nichol A, Caron NR, et al. Effect of community population size on breast cancer screening, stage distribution, treatment use and outcomes. *Can J Public Health* 2012;103(1):46-52.
98. Dragun AE, Huang B, Tucker TC, et al. Disparities in the application of adjuvant radiotherapy after breast-conserving surgery for early stage breast cancer: impact on overall survival. *Cancer* 2011;117(12):2590-8.
99. Ess S, Savidan A, Frick H, et al. Geographic variation in breast cancer care in Switzerland. *Cancer Epidemiol* 2010;34(2):116-21.
100. Mac Bride MB, Neal L, Dilaveri CA, et al. Factors Associated with Surgical Decision Making in Women with Early-Stage Breast Cancer: A Literature Review. *Journal of Womens Health* 2013;22(3):236-42.
101. Markossian TW, Hines RB. Disparities in late stage diagnosis, treatment, and breast cancer-related death by race, age, and rural residence among women in Georgia. *Women Health* 2012;52(4):317-35.
102. Zhong T, Fernandes KA, Saskin R, et al. Barriers to Immediate Breast Reconstruction in the Canadian Universal Health Care System. *J Clin Oncol* 2014;32(20):2133-41.
103. Baade PD, Yu XQ, Smith DP, et al. Geographic disparities in prostate cancer outcomes--review of international patterns. *Asian Pac J Cancer Prev* 2015;16(3):1259-75.
104. Chawla N, Butler EN, Lund J, et al. Patterns of colorectal cancer care in Europe, Australia, and New Zealand. *J Natl Cancer Inst Monogr* 2013;2013(46):36-61.

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



## Additional file 1 Database-specific search queries by individual clinical questions

Electronic databases searched: PubMed (1990- March Week 1, 2015), EMBASE (1990- March Week 1, 2015) and CINAHL (1994- March Week 1, 2015)

All search queries were conducted in a stepwise manner by breaking down each question into key concepts. Each numbered step in Tables below corresponds to the query used for an individual element such as Breast Cancer or Australia. For each element alternative terms were used to cover all possible synonyms for that component. Finally the individual search queries were combined to create the final search query using BOOLEAN operators such as “AND” or “OR”.

### 1. In women diagnosed with breast cancer, do non-metropolitan women have poorer breast cancer survival compared to metropolitan women in Australia?

#### PUBMED search query

Search	Query
#1	((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms])
#2	("australia"[MeSH Terms] OR Australia/epidemiology)
#3	((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract])))
#4	((((((((((("survival"[MeSH Terms]) OR mortality[MeSH Terms]) OR "survival rate"[MeSH Terms]) OR "disease free survival"[MeSH Terms]) OR excess mortality[MeSH Terms]) OR survival analyses[MeSH Terms]) OR survival analysis[MeSH Terms]) OR cancer-specific survival[MeSH Terms]) OR event free survival[MeSH Terms])
#5	((((((((((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms])))) AND (((("australia"[MeSH Terms] OR Australia/epidemiology)))) AND (((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract])))) NOT (((((population, indigenous[MeSH Terms]) OR populations, indigenous[MeSH Terms]) OR oceanic ancestry group[MeSH Terms])))) AND (((((((((((("survival"[MeSH Terms]) OR mortality[MeSH Terms]) OR "survival rate"[MeSH Terms]) OR "disease free survival"[MeSH Terms]) OR excess mortality[MeSH Terms]) OR prognosis[MeSH Terms]) OR survival analyses[MeSH Terms]) OR survival analysis[MeSH Terms]) OR cancer-specific survival[MeSH Terms]) OR event free survival[MeSH Terms]))))



EMBASE search query (via EBSCO host)

Search	Query
#1	'breast cancer'/exp OR 'breast cancer'
#2	'australia'/exp
#3	'rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity'
#4	'survival'/exp OR 'survival' OR 'cancer mortality'/exp OR 'cancer mortality'
#5	'breast cancer'/exp OR 'breast cancer' AND 'australia'/exp AND ('rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity') AND ('survival'/exp OR 'survival' OR 'cancer mortality'/exp OR 'cancer mortality') AND [english]/lim AND [female]/lim AND [1990-2015]/py

CINAHL search query (via EBSCO host)

Search	Query
S1	(MH "Breast Neoplasms+") OR "breast neoplasm"
S2	(MH "Australia+")
S3	(S1 AND S2)
S4	(MH "Population Characteristics") OR (MH "Rural Health Centers") OR (MH "Hospitals, Rural") OR (MH "Rural Population") OR (MH "Rural Health Services") OR (MH "Rural Areas") OR (MH "Rural Health") OR (MH "Rural Health Nursing") OR (MH "Socioeconomic Factors+") OR (MH "Social Determinants of Health") OR (MH "Healthcare Disparities") OR (MH "Health Status Disparities") OR (MH "Health Services Needs and Demand+") OR TX geography OR TX rural
S5	(MH "Survival") OR (MH "Survival Analysis+") OR (MH "Mortality+") OR TX 'survival'
S6	S3 AND S4 AND S5; English Language; Peer Reviewed; Human

2. In women diagnosed with breast cancer, do non-metropolitan women have different socio-demographic characteristics compared to metropolitan women in Australia?

PUBMED search query

Search	Query
#1	((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms])
#2	("australia"[MeSH Terms] OR Australia/epidemiology)
#3	((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract])))

Search	Query
#4	((((((((((((((((((aged[MeSH Terms]) OR age factors[MeSH Terms]) OR middle aged[MeSH Terms]) OR medicare[MeSH Terms]) OR age group*[MeSH Terms]) OR major medical insurance[MeSH Terms]) OR insurance coverage[MeSH Terms]) OR insurance, health[MeSH Terms]) OR life style*[MeSH Terms]) OR education[Title/Abstract]) OR "occupational status"[MeSH Terms]) OR educational status[MeSH Terms]) OR comorbidities[MeSH Terms]) OR social support[MeSH Terms]) OR marital status[MeSH Terms]) OR risk factors[MeSH Terms]) OR income*[MeSH Terms]) OR health status[MeSH Terms]) OR body mass index*[MeSH Terms]) OR "smoking/epidemiology"[MeSH Terms]) OR "alcohol drinking/epidemiology"[MeSH Terms])))
#5	((((((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms]))) AND (((("australia"[MeSH Terms] OR Australia/epidemiology)))) AND (((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract]))) NOT (((population, indigenous[MeSH Terms]) OR populations, indigenous[MeSH Terms]) OR oceanic ancestry group[MeSH Terms]))) AND (((((((((((((((((((aged[MeSH Terms]) OR age factors[MeSH Terms]) OR middle aged[MeSH Terms]) OR medicare[MeSH Terms]) OR age group*[MeSH Terms]) OR major medical insurance[MeSH Terms]) OR insurance coverage[MeSH Terms]) OR insurance, health[MeSH Terms]) OR life style*[MeSH Terms]) OR education[Title/Abstract]) OR "occupational status"[MeSH Terms]) OR educational status[MeSH Terms]) OR comorbidities[MeSH Terms]) OR social support[MeSH Terms]) OR marital status[MeSH Terms]) OR risk factors[MeSH Terms]) OR income*[MeSH Terms]) OR health status[MeSH Terms]) OR body mass index*[MeSH Terms]) OR "smoking/epidemiology"[MeSH Terms]) OR "alcohol drinking/epidemiology"[MeSH Terms]))) AND incidence[MeSH Terms])

#### EMBASE search query (via EBSCO host)

Search	Query
#1	'breast cancer'/exp OR 'breast cancer'
#2	'australia'/exp
#3	'rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'demography'/exp OR 'demography' OR 'socioeconomics'/exp OR 'socioeconomics' OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health disparity' OR 'health care disparity'/exp OR 'health care disparity'
#4	(age OR 'risk factor' OR 'lifestyle' OR 'health insurance' OR 'comorbidity') AND ('incidence'/exp OR 'incidence')
#5	'breast cancer'/exp OR 'breast cancer' AND 'australia'/exp AND ('rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'demography'/exp OR 'demography' OR 'socioeconomics'/exp OR 'socioeconomics' OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health disparity' OR 'health care disparity'/exp OR 'health care disparity') AND (age OR 'risk factor' OR 'lifestyle' OR 'health insurance' OR 'comorbidity') AND ('incidence'/exp OR 'incidence') AND [english]/lim AND [female]/lim AND [1990-2015]/py

#### CINAHL search query (via EBSCO host)

Search	Query
S1	(MH "Breast Neoplasms+") OR "breast neoplasm"
S2	(MH "Australia+")
S3	(S1 AND S2)

Search	Query
S4	(MH "Population Characteristics") OR (MH "Rural Health Centers") OR (MH "Hospitals, Rural") OR (MH "Rural Population") OR (MH "Rural Health Services") OR (MH "Rural Areas") OR (MH "Rural Health") OR (MH "Rural Health Nursing") OR (MH "Socioeconomic Factors+") OR (MH "Social Determinants of Health") OR (MH "Healthcare Disparities") OR (MH "Health Status Disparities") OR (MH "Health Services Needs and Demand+") OR TX geography OR TX rural
S5	(MH "Middle Age") OR (MH "Age Factors") OR (MH "Life Style+") OR (MH "Risk Factors+") OR (MH "Insurance, Health+") OR (MH "Insurance, Health+") OR (MH "Marital Status+") (MH "Demography+") OR (MH "Residence Characteristics+") OR (MH "Geographic Factors") OR (MH "Comorbidity") OR "comorbidities"
S6	S3 AND S4 AND S5; English Language; Peer Reviewed; Human

**3. In women diagnosed with breast cancer, do non-metropolitan women have more advanced tumour characteristics compared to metropolitan women in Australia?**

**PUBMED search query**

Search	Query
#1	((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms])
#2	("australia"[MeSH Terms] OR Australia/epidemiology)
#3	((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract])))
#4	((((((((((((((((((neoplasm staging/epidemiology"[MeSH Terms]) OR pathology, clinical[MeSH Terms]) OR diagnostic molecular pathology[MeSH Terms]) OR stage[Title/Abstract]) OR advanced[Title/Abstract]) OR early[Title/Abstract]) OR spread[Title/Abstract]) OR large[Title/Abstract]) OR size[Title/Abstract]) OR grade[Title/Abstract]) OR bifocal[Title/Abstract]) OR multifocal[Title/Abstract]) OR neoplasm metastases[MeSH Terms]) OR neoplasm metastasis[MeSH Terms]) OR lymphatic metastasis[MeSH Terms]) ) )
#5	((((((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms]))) AND (((("australia"[MeSH Terms] OR Australia/epidemiology)))) AND (((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract]))) NOT (((((population, indigenous[MeSH Terms]) OR populations, indigenous[MeSH Terms]))) AND (((((((((((((((((((neoplasm staging/epidemiology"[MeSH Terms]) OR pathology, clinical[MeSH Terms]) OR diagnostic molecular pathology[MeSH Terms]) OR stage[Title/Abstract]) OR advanced[Title/Abstract]) OR early[Title/Abstract]) OR spread[Title/Abstract]) OR large[Title/Abstract]) OR size[Title/Abstract]) OR grade[Title/Abstract]) OR bifocal[Title/Abstract]) OR multifocal[Title/Abstract]) OR "multiple primaries"[Text Word]) OR neoplasm metastases[MeSH Terms]) OR neoplasm metastasis[MeSH Terms]) OR lymphatic metastasis[MeSH Terms]) ) ) ) NOT ((((((quality of life[MeSH Terms]) OR "survivors/psychology"[MeSH Terms]) OR genes, brca1[MeSH Terms]) OR genes, brca2[MeSH Terms]) OR brca1 gene[MeSH Terms]) OR brca2 gene[MeSH Terms]) OR BRCA*[Text Word]))

**EMBASE search query (via EBSCO host)**

Search	Query
#1	'breast cancer'/exp OR 'breast cancer'
#2	'australia'/exp
#3	'rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity'
#4	'cancer staging'/exp OR 'cancer staging' OR 'cancer grading' OR 'cancer size' OR 'metastasis'/exp OR 'metastasis'
#5	'breast cancer'/exp OR 'breast cancer' AND 'australia'/exp AND ('rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity') AND ('cancer staging'/exp OR 'cancer staging' OR 'cancer grading' OR 'cancer size' OR 'metastasis'/exp OR 'metastasis') AND [english]/lim AND [female]/lim AND [1990-2015]/py

**CINAHL search query (via EBSCO host)**

Search	Query
S1	(MH "Breast Neoplasms+") OR "breast neoplasm"
S2	(MH "Australia+")
S3	(S1 AND S2)
S4	(MH "Population Characteristics") OR (MH "Rural Health Centers") OR (MH "Hospitals, Rural") OR (MH "Rural Population") OR (MH "Rural Health Services") OR (MH "Rural Areas") OR (MH "Rural Health") OR (MH "Rural Health Nursing") OR (MH "Socioeconomic Factors+") OR (MH "Social Determinants of Health") OR (MH "Healthcare Disparities") OR (MH "Health Status Disparities") OR (MH "Health Services Needs and Demand+") OR TX geography OR TX rural
S5	(MM "Neoplasm Staging") OR (MM "Neoplasms, Multiple Primary+") OR AB 'cancer grade' OR "cancer stage"
S6	S3 AND S4 AND S5; English Language; Peer Reviewed; Human

#### 4. In women diagnosed with breast cancer, are non-metropolitan women in the breast screening target group less likely to access breast cancer screening services compared to metropolitan women in Australia?

**PUBMED search query**

Search	Query
#1	((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms])
#2	("australia"[MeSH Terms] OR Australia/epidemiology)
#3	((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract]) ))))))))

Search	Query
#4	((((((((((cancer screening[MeSH Terms]) OR "mammography/utilization"[MeSH Terms]) OR "screening rates"[Text Word]) OR "mammography/statistics and numerical data"[MeSH Terms]) OR mass screening[MeSH Terms]) OR BreastScreen[Title/Abstract] ))))))
#5	((((((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms]))) AND (((("australia"[MeSH Terms] OR Australia/epidemiology)))) AND (((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract]))) NOT (((((population, indigenous[MeSH Terms]) OR populations, indigenous[MeSH Terms]))) AND (((((((((((cancer screening[MeSH Terms]) OR "mammography/utilization"[MeSH Terms]) OR "screening rates"[Text Word]) OR "mammography/statistics and numerical data"[MeSH Terms]) OR mass screening[MeSH Terms]) OR BreastScreen[Title/Abstract] ))))))

**EMBASE search query (via EBSCO host)**

Search	Query
#1	'breast cancer'/exp OR 'breast cancer'
#2	'australia'/exp
#3	'rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity'
#4	'mammography'/exp OR 'mammography' OR 'cancer screening'/exp)
#5	'breast cancer'/exp OR 'breast cancer' AND 'australia'/exp AND ('rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity') AND ('mammography'/exp OR 'mammography' OR 'cancer screening'/exp) AND (rate* OR utiliz*) AND [english]/lim AND [female]/lim AND [1990-2015]/py

**CINAHL search query (via EBSCO host)**

Search	Query
S1	(MH "Breast Neoplasms+") OR "breast neoplasm"
S2	(MH "Australia+")
S3	(S1 AND S2)
S4	(MH "Population Characteristics") OR (MH "Rural Health Centers") OR (MH "Hospitals, Rural") OR (MH "Rural Population") OR (MH "Rural Health Services") OR (MH "Rural Areas") OR (MH "Rural Health") OR (MH "Rural Health Nursing") OR (MH "Socioeconomic Factors+") OR (MH "Social Determinants of Health") OR (MH "Healthcare Disparities") OR (MH "Health Status Disparities") OR (MH "Health Services Needs and Demand+") OR TX geography OR TX rural
S5	(MH "Mammography") OR (MH "Cancer Screening")
S6	S3 AND S4 AND S5; English Language; Peer Reviewed; female

**5. In women diagnosed with breast cancer, are non-metropolitan women in the breast screening target group less likely to adhere to recommended breast cancer screening intervals (2 yearly) compared to metropolitan women in Australia?**

**PUBMED search query**

Search	Query
#1	((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms])
#2	("australia"[MeSH Terms] OR Australia/epidemiology)
#3	((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract]) )))))))
#4	((((((((((((((((((cancer screening[MeSH Terms]) OR mammography/epidemiology[MeSH Terms]) OR "mammography/utilization"[MeSH Terms]) OR ("mammography/statistics and numerical data"[MeSH Terms]) OR "screening intervals"[Text Word]) OR "second round"[Text Word]) OR "adherence"[Text Word]) OR "non-attendance"[Text Word]) )))))))
#5	((((((((((((((((((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms]) )))) AND (((("australia"[MeSH Terms] OR Australia/epidemiology)))) AND (((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract]) ))))))) AND (((((((((((((((((((cancer screening[MeSH Terms]) OR mammography/epidemiology[MeSH Terms]) OR "mammography/utilization"[MeSH Terms]) OR ("mammography/statistics and numerical data"[MeSH Terms]) OR "screening intervals"[Text Word]) OR "second round"[Text Word]) OR "adherence"[Text Word]) OR "non-attendance"[Text Word]) ))))))) NOT (((populations, indigenous[MeSH Terms]) OR Chinese[Text Word]) OR brca*[Title/Abstract]) OR advertis* [Title/Abstract]))))

**EMBASE search query (via EBSCO host)**

Search	Query
#1	'breast cancer'/exp OR 'breast cancer'
#2	'australia'/exp
#3	'rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity'
#4	'mammography'/exp OR 'mammography' OR 'cancer screening'/exp)
#5	'breast cancer'/exp OR 'breast cancer' AND 'australia'/exp AND ('rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity') AND ('mammography'/exp/mj OR 'mammography' OR 'cancer screening'/exp) AND (rescreen* OR second* OR return*) AND [english]/lim AND [female]/lim AND [1990-2015]/py

CINAHL search query (via EBSCO host)

Search	Query
S1	(MH "Breast Neoplasms+") OR "breast neoplasm"
S2	(MH "Australia+")
S3	(S1 AND S2)
S4	(MH "Population Characteristics") OR (MH "Rural Health Centers") OR (MH "Hospitals, Rural") OR (MH "Rural Population") OR (MH "Rural Health Services") OR (MH "Rural Areas") OR (MH "Rural Health") OR (MH "Rural Health Nursing") OR (MH "Socioeconomic Factors+") OR (MH "Social Determinants of Health") OR (MH "Healthcare Disparities") OR (MH "Health Status Disparities") OR (MH "Health Services Needs and Demand+") OR TX geography OR TX rural
S5	(MH "Mammography") OR (MH "Cancer Screening")
S6	TX rescreen* OR TX "mammography second"
S7	S3 AND S4 AND S5 AND S6; English Language; Peer Reviewed; female

6. In women diagnosed with breast cancer, are there differences in clinical management between non-metropolitan and metropolitan women in Australia?

PUBMED search query

Search	Query
#1	((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms])
#2	("australia"[MeSH Terms] OR Australia/epidemiology)
#3	((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms]) OR health services accessibility [MeSH Terms]) OR ((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract]) )))))))
#4	((((((((((((((((((("lymph node excision/statistics and numerical data"[MeSH Terms]) OR adjuvant radiotherapy[MeSH Terms]) OR adjuvant chemotherapy[MeSH Terms]) OR neoadjuvant[MeSH Terms]) OR mastectomy[MeSH Terms]) OR breast conserving surgeries[MeSH Terms]) OR breast conserving surgery[MeSH Terms]) OR reconstruction, breast[MeSH Terms]) OR clinical audit[MeSH Terms]) OR clinical audits[MeSH Terms]) OR "clinical management"[Text Word]) OR cancer treatment protocol[Text Word]) OR "hormonal therapy"[Text Word] OR "sentinel node biopsy"[Text Word] )))))))
#5	((((((((((((((((((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms]) )))) AND (((("australia"[MeSH Terms] OR Australia/epidemiology))) AND (((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR ((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract]) ))))))) AND (((((((((((((((((((("lymph node excision/statistics and numerical data"[MeSH Terms]) OR adjuvant radiotherapy[MeSH Terms]) OR adjuvant chemotherapy[MeSH Terms]) OR neoadjuvant[MeSH Terms]) OR mastectomy[MeSH Terms]) OR breast conserving surgeries[MeSH Terms]) OR breast conserving surgery[MeSH Terms]) OR reconstruction, breast[MeSH Terms]) OR clinical audit[MeSH Terms]) OR clinical audits[MeSH Terms]) OR "clinical management"[Text Word]) OR cancer treatment protocol[Text Word]) OR "hormonal therapy"[Text Word] OR "sentinel node biopsy"[Text Word] )))))))



**EMBASE search query (via EBSCO host)**

Search	Query
#1	'breast cancer'/exp OR 'breast cancer'
#2	'australia'/exp
#3	'rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity'
#4	'clinical practice'/exp OR 'cancer adjuvant chemotherapy'/exp OR 'cancer chemotherapy'/exp OR 'cancer radiotherapy'/exp OR 'cancer hormonal therapy'/exp OR 'mastectomy'/exp OR 'mastectomy' OR 'lymph node dissection'/exp OR 'breast reconstruction'/exp OR 'breast reconstruction' OR 'cancer therapy multimodality'/exp
#5	'breast cancer'/exp OR 'breast cancer' AND 'australia'/exp AND ('rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity') AND ('clinical practice'/exp OR 'cancer adjuvant chemotherapy'/exp OR 'cancer chemotherapy'/exp OR 'cancer radiotherapy'/exp OR 'cancer hormonal therapy'/exp OR 'mastectomy'/exp OR 'mastectomy' OR 'lymph node dissection'/exp OR 'breast reconstruction'/exp OR 'breast reconstruction' OR 'cancer therapy multimodality'/exp) AND [english]/lim AND [female]/lim AND [1990-2015]/py

**CINAHL search query (via EBSCO host)**

Search	Query
S1	(MH "Breast Neoplasms+") OR "breast neoplasm"
S2	(MH "Australia+")
S3	(S1 AND S2)
S4	(MH "Population Characteristics") OR (MH "Rural Health Centers") OR (MH "Hospitals, Rural") OR (MH "Rural Population") OR (MH "Rural Health Services") OR (MH "Rural Areas") OR (MH "Rural Health") OR (MH "Rural Health Nursing") OR (MH "Socioeconomic Factors+") OR (MH "Social Determinants of Health") OR (MH "Healthcare Disparities") OR (MH "Health Status Disparities") OR (MH "Health Services Needs and Demand+") OR TX geography OR TX rural
S5	(MH "Mastectomy+") OR (MH "Lumpectomy") OR (MH "Chemotherapy, Cancer+") OR (MH "Chemotherapy, Adjuvant") OR (MH "Radiotherapy, Cancer+") OR (MH "Radiotherapy, Adjuvant") OR (MH "Combined Modality Therapy+") OR (MH "Breast Reconstruction") OR "Surgical patterns" OR "case management"
S6	S3 AND S4 AND S5; English Language; Peer Reviewed; female

**7. In women diagnosed with breast cancer, are non-metropolitan women less likely to receive the recommended clinical management compared to metropolitan women in Australia**

**PUBMED search query**

Search	Query
#1	((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms])
#2	("australia"[MeSH Terms] OR Australia/epidemiology)

Search	Query
#3	((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract])))
#4	((((((((((((((("lymph node excision/statistics and numerical data"[MeSH Terms])) OR adjuvant radiotherapy[MeSH Terms]) OR adjuvant chemotherapy[MeSH Terms]) OR neoadjuvant[MeSH Terms]) OR "sentinel node biopsy"[Text Word]) OR "hormonal therapy"[ Text Word] OR (((chemotherapy[Text Word]) OR radiotherapy[Text Word]) ))))
#5	((((((((((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms]))) AND (((("australia"[MeSH Terms] OR Australia/epidemiology))) AND (((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract]))) AND (((((((((((("lymph node excision/statistics and numerical data"[MeSH Terms]) OR adjuvant radiotherapy[MeSH Terms]) OR adjuvant chemotherapy[MeSH Terms]) OR neoadjuvant[MeSH Terms]) OR "sentinel node biopsy"[Text Word]) OR "hormonal therapy"[ Text Word] OR (((chemotherapy[Text Word]) OR radiotherapy[Text Word]) ))))

**EMBASE search query (via EBSCO host)**

Search	Query
#1	'breast cancer'/exp OR 'breast cancer'
#2	'australia'/exp
#3	'rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity'
#4	'cancer adjuvant chemotherapy'/exp OR 'cancer adjuvant chemotherapy' OR 'cancer chemotherapy'/exp OR 'cancer chemotherapy' OR 'cancer combination chemotherapy'/exp OR 'cancer combination chemotherapy' OR 'cancer radiotherapy'/exp OR 'cancer radiotherapy' OR 'cancer hormonal therapy'/exp OR 'cancer hormonal therapy' OR 'lymph node dissection'/exp OR 'lymph node dissection' OR 'cancer therapy'/exp OR 'sentinel node biopsy' OR 'cancer therapy multimodality'/exp OR 'cancer therapy multimodality'
#5	'breast cancer'/exp OR 'breast cancer' AND 'australia'/exp AND ('rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity') AND ('cancer adjuvant chemotherapy'/exp OR 'cancer adjuvant chemotherapy' OR 'cancer chemotherapy'/exp OR 'cancer chemotherapy' OR 'cancer combination chemotherapy'/exp OR 'cancer combination chemotherapy' OR 'cancer radiotherapy'/exp OR 'cancer radiotherapy' OR 'cancer hormonal therapy'/exp OR 'cancer hormonal therapy' OR 'lymph node dissection'/exp OR 'lymph node dissection' OR 'cancer therapy'/exp OR 'sentinel node biopsy' OR 'cancer therapy multimodality'/exp OR 'cancer therapy multimodality') AND [english]/lim AND [female]/lim AND [1990-2015]/py

**CINAHL search query (via EBSCO host)**

Search	Query
S1	(MH "Breast Neoplasms+") OR "breast neoplasm"

Search	Query
S2	(MH "Australia+")
S3	(S1 AND S2)
S4	(MH "Population Characteristics") OR (MH "Rural Health Centers") OR (MH "Hospitals, Rural") OR (MH "Rural Population") OR (MH "Rural Health Services") OR (MH "Rural Areas") OR (MH "Rural Health") OR (MH "Rural Health Nursing") OR (MH "Socioeconomic Factors+") OR (MH "Social Determinants of Health") OR (MH "Healthcare Disparities") OR (MH "Health Status Disparities") OR (MH "Health Services Needs and Demand+") OR TX geography OR TX rural
S5	(MH "Chemotherapy, Cancer+") OR (MH "Chemotherapy, Adjuvant") OR (MH "Radiotherapy, Cancer+") OR (MH "Radiotherapy, Adjuvant") OR (MH "Combined Modality Therapy+") OR (MH "Breast Reconstruction")
S6	S3 AND S4 AND S5; English Language; Peer Reviewed; female

# **8. In women diagnosed with breast cancer, are non-metropolitan women more likely to experience delays in referral to breast cancer specialist clinicians compared to metropolitan women in Australia?**

## **PUBMED search query**

Search	Query
#1	((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms])
#2	("australia"[MeSH Terms] OR Australia/epidemiology)
#3	((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract])]))))))
#4	((((((((((((((((((referral and consultation[MeSH Terms]) OR physician's practice patterns[MeSH Terms]) OR ("hospitals, rural/statistics and numerical data"[MeSH Terms])) OR ("geography, medical/statistics and numerical data"[MeSH Terms])) OR "hospitals, high volume"[MeSH Terms]) OR "hospitals, low volume"[MeSH Terms]) OR oncologist[Title/Abstract]) OR caseload[Title/Abstract]) OR "low caseload"[Text Word]) OR "high caseload"[MeSH Terms]) OR specialist[MeSH Terms]) OR "hospitals, public"[MeSH Terms]) OR "hospitals, private"[MeSH Terms]) OR "specialties, surgical/epidemiology"[MeSH Terms]
#5	((((((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms]))) AND (((("australia"[MeSH Terms] OR Australia/epidemiology)))) AND (((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract])))) NOT (((((population, indigenous[MeSH Terms]) OR populations, indigenous[MeSH Terms]))) AND (((((((((((((((((((referral and consultation[MeSH Terms]) OR physician's practice patterns[MeSH Terms]) OR ("hospitals, rural/statistics and numerical data"[MeSH Terms])) OR ("geography, medical/statistics and numerical data"[MeSH Terms])) OR "hospitals, high volume"[MeSH Terms]) OR "hospitals, low volume"[MeSH Terms]) OR oncologist[Title/Abstract]) OR caseload[Title/Abstract]) OR "low caseload"[Text Word]) OR "high caseload"[MeSH Terms]) OR specialist[MeSH Terms]) OR "hospitals, public"[MeSH Terms]) OR "hospitals, private"[MeSH Terms]) OR "specialties, surgical/epidemiology"[MeSH Terms] NOT screen*[Text Word])) NOT interventio*[Text Word])

EMBASE search query (via EBSCO host)

Search	Query
#1	'breast cancer'/exp OR 'breast cancer'
#2	'australia'/exp
#3	'rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity'
#4	'referral and consultation'/exp OR 'referral and consultation' OR 'public hospitals' OR 'private hospitals' OR (surgical AND caseload) OR 'hospital volume' OR 'surgical volume'
#5	'breast cancer'/exp OR 'breast cancer' AND 'australia'/exp AND ('rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity') AND ('referral and consultation'/exp OR 'referral and consultation' OR 'public hospitals' OR 'private hospitals' OR (surgical AND caseload) OR 'hospital volume' OR 'surgical volume') AND [english]/lim AND [female]/lim AND [1990-2015]/py

CINAHL search query (via EBSCO host)

Search	Query
S1	(MH "Breast Neoplasms+") OR "breast neoplasm"
S2	(MH "Australia+")
S3	(S1 AND S2)
S4	(MH "Population Characteristics") OR (MH "Rural Health Centers") OR (MH "Hospitals, Rural") OR (MH "Rural Population") OR (MH "Rural Health Services") OR (MH "Rural Areas") OR (MH "Rural Health") OR (MH "Rural Health Nursing") OR (MH "Socioeconomic Factors+") OR (MH "Social Determinants of Health") OR (MH "Healthcare Disparities") OR (MH "Health Status Disparities") OR (MH "Health Services Needs and Demand+") OR TX geography OR TX rural
S5	(MH "Referral and Consultation+")
S6	S3 AND S4 AND S5; English Language; Peer Reviewed; female

9. In women diagnosed with breast cancer, do non-metropolitan women experience fewer treatment options compared to metropolitan women in Australia?

PUBMED search query

Search	Query
#1	((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms])
#2	("australia"[MeSH Terms] OR Australia/epidemiology)
#3	((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract])))

Search	Query
#4	((((((((((((((travel times[MeSH Terms]) OR travel[MeSH Terms]) OR choice behavior*[MeSH Terms]) OR "waiting lists"[MeSH Terms]) OR cost, treatment[MeSH Terms])) OR time factor[MeSH Terms]) OR time factors[MeSH Terms]) OR (health services needs and demands[MeSH Terms] OR ((patient satisfaction[MeSH Terms]) OR choice*[Title/Abstract]) OR decision[Title/Abstract]))
#5	((((((((((((((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms])) AND (((("australia"[MeSH Terms] OR Australia/epidemiology)))) AND (((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract])))) NOT (((population, indigenous[MeSH Terms]) OR populations, indigenous[MeSH Terms])))) AND (((((((((((((((travel times[MeSH Terms]) OR travel[MeSH Terms]) OR choice behavior*[MeSH Terms]) OR "waiting lists"[MeSH Terms]) OR cost, treatment[MeSH Terms]) OR time factor[MeSH Terms]) OR time factors[MeSH Terms]) OR (health services needs and demands[MeSH Terms] OR ((patient satisfaction[MeSH Terms]) OR choice*[Title/Abstract]) OR decision[Title/Abstract]) NOT (((screen*[Title/Abstract]) OR brca*[Title/Abstract]) OR BRCA*[Title/Abstract]) OR mammogr*[Title/Abstract]) OR follow-up[Title/Abstract]))

#### EMBASE search query (via EBSCO host)

Search	Query
#1	'breast cancer'/exp OR 'breast cancer'
#2	'australia'/exp
#3	'rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity'
#4	'patient decision making'/exp OR 'patient decision making' OR 'patient decision aid' OR 'patient delay'
#5	'breast cancer'/exp OR 'breast cancer' AND 'australia'/exp AND ('rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity') AND 'patient decision making'/exp OR 'patient decision making' OR 'patient decision aid' OR 'patient delay' AND [english]/lim AND [female]/lim AND [1990-2015]/py

#### CINAHL search query (via EBSCO host)

Search	Query
S1	(MH "Breast Neoplasms+") OR "breast neoplasm"
S2	(MH "Australia+")
S3	(S1 AND S2)
S4	(MH "Population Characteristics") OR (MH "Rural Health Centers") OR (MH "Hospitals, Rural") OR (MH "Rural Population") OR (MH "Rural Health Services") OR (MH "Rural Areas") OR (MH "Rural Health") OR (MH "Rural Health Nursing") OR (MH "Socioeconomic Factors+") OR (MH "Social Determinants of Health") OR (MH "Healthcare Disparities") OR (MH "Health Status Disparities") OR (MH "Health Services Needs and Demand+") OR TX geography OR TX rural
S5	(MH "Decision Making, Patient+")
S6	S3 AND S4 AND S5; English Language; Peer Reviewed; female

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46

**10. In women diagnosed with breast cancer, are non-metropolitan women less likely to complete prescribed treatment compared to metropolitan women in Australia?**

**PUBMED search query**

Search	Query
#1	((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms])
#2	("australia"[MeSH Terms] OR Australia/epidemiology)
#3	((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR ((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract]))))))
#4	((((((((((((((((((hospitals, rural/statistics and numerical data"[MeSH Terms])) OR patient compliance[MeSH Terms]) OR compliance, patient[MeSH Terms]) OR compliance, protocol[MeSH Terms]) OR non compliance, patient[MeSH Terms]) OR patient acceptance of health care[MeSH Terms]) OR patient participation[MeSH Terms])) OR clinical audit*[MeSH Terms]) OR treatment refusal[MeSH Terms])
#5	((((((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms]))) AND (((("australia"[MeSH Terms] OR Australia/epidemiology)))) ((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR ((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract]))) NOT (((((population, indigenous[MeSH Terms]) OR populations, indigenous[MeSH Terms]))) AND (((((((((((((((((((hospitals, rural/statistics and numerical data"[MeSH Terms])) OR patient compliance[MeSH Terms]) OR compliance, patient[MeSH Terms]) OR compliance, protocol[MeSH Terms]) OR non compliance, patient[MeSH Terms]) OR patient acceptance of health care[MeSH Terms]) OR patient participation[MeSH Terms])) OR clinical audit*[MeSH Terms]) OR treatment refusal[MeSH Terms])

**EMBASE search query (via EBSCO host)**

Search	Query
#1	'breast cancer'/exp OR 'breast cancer'
#2	'australia'/exp
#3	'rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity'
#4	'patient compliance'/exp OR 'patient compliance' OR 'treatment refusal'/exp OR 'treatment refusal'
#5	'breast cancer'/exp OR 'breast cancer' AND 'australia'/exp AND ('rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity') AND ('patient compliance'/exp OR 'patient compliance' OR 'treatment refusal'/exp OR 'treatment refusal') AND [english]/lim AND [female]/lim AND [1990-2015]/py

**CINAHL search query (via EBSCO host)**

Search	Query
S1	(MH "Breast Neoplasms+") OR "breast neoplasm"
S2	(MH "Australia+")
S3	(S1 AND S2)
S4	(MH "Population Characteristics") OR (MH "Rural Health Centers") OR (MH "Hospitals, Rural") OR (MH "Rural Population") OR (MH "Rural Health Services") OR (MH "Rural Areas") OR (MH "Rural Health") OR (MH "Rural Health Nursing") OR (MH "Socioeconomic Factors+") OR (MH "Social Determinants of Health") OR (MH "Healthcare Disparities") OR (MH "Health Status Disparities") OR (MH "Health Services Needs and Demand+") OR TX geography OR TX rural
S5	(MH "Patient Compliance+") OR (MH "Treatment Refusal")
S6	S3 AND S4 AND S5; English Language; Peer Reviewed; female

**11. In women diagnosed with breast cancer, are non-metropolitan women less likely to participate in recommended follow-up compared to metropolitan women in Australia?**

**PUBMED search query**

Search	Query
#1	((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms])
#2	("australia"[MeSH Terms] OR Australia/epidemiology)
#3	((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract])))
#4	((((((((((((((((((survivorship[MeSH Terms]) OR long term survivors[MeSH Terms]) OR "survivorship care"[Title/Abstract]) OR "survivorship plans"[Title/Abstract]) OR long term care[MeSH Terms])))
#5	((((((((((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms]))) AND (((("australia"[MeSH Terms] OR Australia/epidemiology)))) AND (((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract]))) NOT (((population, indigenous[MeSH Terms]) OR populations, indigenous[MeSH Terms]))) AND (((((((((((((((((((survivorship[MeSH Terms]) OR long term survivors[MeSH Terms]) OR "survivorship care"[Title/Abstract]) OR "survivorship plans"[Title/Abstract]) OR long term care[MeSH Terms]))) NOT (((quality of life[MeSH Terms]) OR asian continental ancestry group[MeSH Terms]) OR stress, psychological[MeSH Terms]))



**EMBASE search query (via EBSCO host)**

Search	Query
#1	'breast cancer'/exp OR 'breast cancer'
#2	'australia'/exp
#3	'rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity'
#4	'postoperative care'/exp OR 'postoperative care' OR 'patient care'/exp OR 'patient care' OR 'survivorship' OR 'survivorship care plan'
#5	'breast cancer'/exp OR 'breast cancer' AND 'australia'/exp/mj AND ('rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity') AND ('postoperative care'/exp OR 'postoperative care' OR 'patient care'/exp OR 'patient care' OR 'survivorship' OR 'survivorship care plan') AND [english]/lim AND [female]/lim AND [humans]/lim

**CINAHL search query (via EBSCO host)**

Search	Query
S1	(MH "Breast Neoplasms+") OR "breast neoplasm"
S2	(MH "Australia+")
S3	(S1 AND S2)
S4	(MH "Population Characteristics") OR (MH "Rural Health Centers") OR (MH "Hospitals, Rural") OR (MH "Rural Population") OR (MH "Rural Health Services") OR (MH "Rural Areas") OR (MH "Rural Health") OR (MH "Rural Health Nursing") OR (MH "Socioeconomic Factors+") OR (MH "Social Determinants of Health") OR (MH "Healthcare Disparities") OR (MH "Health Status Disparities") OR (MH "Health Services Needs and Demand+") OR TX geography OR TX rural
S5	(MH "Postoperative Care+") OR (MH "Patient Care+") OR (MH "After Care")
S6	S3 AND S4 AND S5; English Language; Peer Reviewed; female

**Additional searches:**

We also searched the INFORMIT database (1994- March Week 1, 2015)

**Informit Health (Australian databases) search query**

Search	Query
#1	(Breast Cancer) OR (Breast Neoplasm)
#2	MH: Australia
#3	( MH:Australia) AND ( (Breast Cancer) OR (Breast Neoplasm))
#4	(( MH:Australia) AND ( (Breast Cancer) OR (Breast Neoplasm))) AND (( ALLTERMS:rural OR geography OR (rural health) OR socioeconomic OR inequalities) )

## Additional file 2: Quality appraisal tools for included quantitative studies

<b>I. Selection bias (Sample selection for cohort studies)</b>	<b>Score</b>
Representative of population of interest	2
Selected group, somewhat representative	1
Highly selected, convenient or not described	0
<b>II. Assessment (or measurement) of exposure and or confounding variables</b>	
Secure records, independent blind assessment	2
Independent assessment un-blinded; self-reported	1
No description or unclear how exposure was assessed	0
<b>III. Assessment (or measurement) of outcome</b>	
Record linkage, independent blind assessment, previously validated/reliable measures	2
Independent assessment un-blinded; self-report, novel measures (validation/ reliability data provided)	1
Novel measures (no validation/reliability tests) or assessment of outcome not described	0
<b>IV. Adequacy of follow-up and/or were all patients included</b>	
Yes (follow-up > 95%) of patients or > 95% of all patients included	2
Reasonable follow-up of all patients or all patients included (>80%)	1
≤ 80% of patients /included patients followed-up, not described or not relevant	0
<b>V. Adequacy of adjustment for confounding: (matching, stratification, multivariate analysis)</b>	
Yes	2
Not clear or not applicable	1
No	0
<b>VI. If there was adjustment for residual confounding</b>	
Study comprehensively controls for age and additional risk factors	2
Study controls for age and most plausible additional factors	1
Minimum matching or adjustment for plausible prognostic variables; no adjustment	0
<b>VII. Attrition (missing data): If a concern was missing data handled appropriately</b>	
Yes	2
Not clear or not applicable	1
No	0
<b>VIII. Statistical methods adequate or appropriate and sufficiently described</b>	
Yes	2
Not clear or not applicable	1
No	0
<b>IX. Data presentation</b>	
Examples of data presented allows clear understanding of data analysis and interpretation	2
Examples provided but do not present a clear interpretation of data	1
Very little data presented or incomplete recording	0

### Additional file 3: Excluded studies with reasons for exclusion

Study Reference	Reason for Exclusion
Achat <i>et al</i> 2005 <sup>1</sup>	No results by residential location of women or for rural women
Andreeva & Pokhrel 2013 <sup>2</sup>	Does not assess one of the considered clinical questions
Azzopardi <i>et al</i> 2014 <sup>3</sup>	No results by residential location of women or for rural women
Banks <i>et al</i> 2010 <sup>4</sup>	No results specifically for female breast cancer patients
Banks <i>et al</i> 2014 <sup>5</sup>	No results specifically for female breast cancer patients
Barratt <i>et al</i> 1999 <sup>6</sup>	No results by residential location or for rural women in target screening age group
Beckmann <i>et al</i> 2011 <sup>7</sup>	Does not assess one of the considered clinical questions
Bell <i>et al</i> 2009 <sup>8</sup>	Does not assess one of the considered clinical questions
Bessen <i>et al</i> 2014 <sup>9</sup>	Does not assess one of the considered clinical questions
Bessen & Karnon 2014 <sup>10</sup>	Does not assess one of the considered clinical questions
Boyages <i>et al</i> 2010 <sup>11</sup>	Does not assess one of the considered clinical questions
Brennan & Spillane 2013 <sup>12</sup>	Review
Brennan & Houssami 2006 <sup>13</sup>	Does not assess one of the considered clinical questions
Brennan <i>et al</i> 2014 <sup>14</sup>	Review
Brennan <i>et al</i> 2010 <sup>15</sup>	Survey of health professionals rather than women with breast cancer
Brennan <i>et al</i> 2010 <sup>16</sup>	Does not assess one of the considered clinical questions
Brennan <i>et al</i> 2011 <sup>17</sup>	Does not assess one of the considered clinical questions
Brennan <i>et al</i> 2011 <sup>18</sup>	Opinion piece
Brown <i>et al</i> 2013 <sup>19</sup>	No results by residential location or for rural women in target screening age group
Buckley <i>et al</i> 2014 <sup>20</sup>	Does not assess one of the considered clinical questions
Budden <i>et al</i> 2007 <sup>21</sup>	Does not assess one of the considered clinical questions
Budden <i>et al</i> 2003 <sup>22</sup>	Does not assess one of the considered clinical questions
Butler-Henderson <i>et al</i> 2014 <sup>23</sup>	In situ and not invasive breast cancer
Canfell 2014 <sup>24</sup>	Review
Carrick <i>et al</i> 1998 <sup>25</sup>	Opinion piece
Chavez-Macgregor & Hortobagyi 2011 <sup>26</sup>	Opinion piece
Chin <i>et al</i> 2008 <sup>27</sup>	In situ and not invasive breast cancer
Chisholm <i>et al</i> 2000 <sup>28</sup>	Does not assess one of the considered clinical questions
Clarke 1998 <sup>29</sup>	Economic analysis: Does not assess one of the considered clinical questions
Clarke 2002 <sup>30</sup>	Economic analysis; Does not assess one of the considered clinical questions
Clover <i>et al</i> 1996 <sup>31</sup>	No results by residential location or for rural women in target screening age group
Cockburn <i>et al</i> 1991 <sup>32</sup>	No results by residential location or for rural women in target screening age group
Cockburn <i>et al</i> 1997 <sup>33</sup>	No results by residential location or for rural women in target screening age group
Coleman <i>et al</i> 2011 <sup>34</sup>	A comparative study across countries only
Coleman <i>et al</i> 2008 <sup>35</sup>	A comparative study across countries only
Craft <i>et al</i> 2010 <sup>36</sup>	No information by patient's residential location; only by treatment centre location
Cramb <i>et al</i> 2012 <sup>37</sup>	Does not assess one of the considered clinical questions
Cramb <i>et al</i> 2011 <sup>38</sup>	No results specifically for female breast cancer patients
Crombie <i>et al</i> 2005 <sup>39</sup>	No results by residential location of women or for rural women
Davey <i>et al</i> 2008 <sup>40</sup>	Does not assess one of the considered clinical questions
Delpizzo 1995 <sup>41</sup>	Does not assess one of the considered clinical questions
Dowling <i>et al</i> 2014 <sup>42</sup>	Does not assess one of the considered clinical questions

Study Reference	Reason for Exclusion
Emery 2010 <sup>43</sup>	Conference abstract
Emery <i>et al</i> 2013 <sup>44</sup>	No results specifically for female breast cancer patients
Fisher <i>et al</i> 2014 <sup>45</sup>	Not Australian-based
Fong <i>et al</i> 2012 <sup>46</sup>	A comparative study across countries only
Fong <i>et al</i> 2012 <sup>47</sup>	A comparative study across countries only
Frensham <i>et al</i> 2014 <sup>48</sup>	No results specifically for female breast cancer patients
Furnival 2004 <sup>49</sup>	Editorial
Furnival 1997 <sup>50</sup>	Editorial
Giles <i>et al</i> 2010 <sup>51</sup>	Methodological paper
Goldsbury <i>et al</i> 2012 <sup>52</sup>	Not breast cancer
Green <i>et al</i> 2013 <sup>53</sup>	Conference abstract
Halkett <i>et al</i> 2014 <sup>54</sup>	Study protocol
Halkett <i>et al</i> 2006 <sup>55</sup>	No results by residential location of women or for rural women
Harden <i>et al</i> 2014 <sup>56</sup>	Conference abstract
Harrison <i>et al</i> 2008 <sup>57</sup>	No results by residential location of women or for rural women
Hayes <i>et al</i> 2010 <sup>58</sup>	No results by residential location of women or for rural women
Heathcote & Armstrong 2007 <sup>59</sup>	Review
Hersch <i>et al</i> 2014 <sup>60</sup>	Study protocol
Heywood <i>et al</i> 1994 <sup>61</sup>	Does not assess one of the considered clinical questions
Hunt <i>et al</i> 2001 <sup>62</sup>	Does not assess one of the considered clinical questions
Hyndman & Holman 2000 <sup>63</sup>	Does not assess one of the considered clinical questions
Hyndman <i>et al</i> 1997 <sup>64</sup>	Does not assess one of the considered clinical questions
Ingram <i>et al</i> 2005 <sup>65</sup>	No information by patient's residential location; only by surgical caseload
Jones 2004 <sup>66</sup>	Opinion piece
Jong <i>et al</i> 2005 <sup>67</sup>	Opinion piece
Kavanagh <i>et al</i> 1999 <sup>68</sup>	Does not assess one of the considered clinical questions
Kiely <i>et al</i> 2013 <sup>69</sup>	Does not assess one of the considered clinical questions
Kiely <i>et al</i> 2010 <sup>70</sup>	Includes women with high breast cancer risk, no results by residential location
Kremser <i>et al</i> 2008 <sup>71</sup>	Does not assess one of the considered clinical questions
Kricker 1998 <sup>72</sup>	Review
Kricker <i>et al</i> 2008 <sup>73</sup>	Does not assess one of the considered clinical questions
Kricker <i>et al</i> 2009 <sup>74</sup>	No results by residential location of women or for rural women
Kwok & White 2011 <sup>75</sup>	Does not assess one of the considered clinical questions
Lawler <i>et al</i> 2012 <sup>76</sup>	Does not assess one of the considered clinical questions
Llewellyn <i>et al</i> 2011 <sup>77</sup>	Does not assess one of the considered clinical questions
Lobb <i>et al</i> 2002 <sup>78</sup>	Includes women with high breast cancer risk, no results by residential location
Lopez <i>et al</i> 2013 <sup>79</sup>	Not breast cancer
Lu <i>et al</i> 2013 <sup>80</sup>	Does not assess one of the considered clinical questions
Luke <i>et al</i> 2006 <sup>81</sup>	Does not assess one of the considered clinical questions
Luke <i>et al</i> 2003 <sup>82</sup>	No results specifically for female breast cancer patients
Magiros <i>et al</i> 2001 <sup>83</sup>	Does not assess one of the considered clinical questions
Marsh <i>et al</i> 2008 <sup>84</sup>	No information by patient's residential location; only by treatment centre location
Mauad <i>et al</i> 2009 <sup>85</sup>	Not Australian-based
McCredie <i>et al</i> 1995 <sup>86</sup>	Review
McMichael <i>et al</i> 2000 <sup>87</sup>	Does not assess one of the considered clinical questions
Moorin & Holman 2006 <sup>88</sup>	Does not assess one of the considered clinical questions
Moran & Warren-Forward 2011 <sup>89</sup>	Does not assess one of the considered clinical questions

Study Reference	Reason for Exclusion
Morley <i>et al</i> 2010 <sup>90</sup>	Only included women from urban areas
Morrell <i>et al</i> 2012 <sup>91</sup>	Does not assess one of the considered clinical questions
Ogunsiji <i>et al</i> 2013 <sup>92</sup>	Does not assess one of the considered clinical questions
Paddison & Yip 2010 <sup>93</sup>	Not breast cancer
Page <i>et al</i> 2006 <sup>94</sup>	Does not assess one of the considered clinical questions
Peters 2012 <sup>95</sup>	Does not assess one of the considered clinical questions
Protani <i>et al</i> 2012 <sup>96</sup>	Does not assess one of the considered clinical questions
Richardson 2013 <sup>97</sup>	Opinion piece
Roder <i>et al</i> 2011 <sup>98</sup>	Conference abstract
Rychetnik <i>et al</i> 2013 <sup>99</sup>	Editorial
Sandelin <i>et al</i> 2003 <sup>100</sup>	Does not assess one of the considered clinical questions
Sharplin <i>et al</i> 2014 <sup>101</sup>	No results specifically for female breast cancer patients
Shugg <i>et al</i> 2002 <sup>102</sup>	Ductal carcinoma and not invasive breast cancer
Smith 2012 <sup>103</sup>	Review
Somogyi <i>et al</i> 2015 <sup>104</sup>	No information by patient's residential location; only by treatment centre location
Speedy & Hase 2000 <sup>105</sup>	Does not assess one of the considered clinical questions
Spillane <i>et al</i> 1999 <sup>106</sup>	No outcomes by patient's residential location; only by treatment centre location
Spillane <i>et al</i> 2001 <sup>107</sup>	No results by residential location of women or for rural women
Spilsbury <i>et al</i> 2005 <sup>108</sup>	Does not assess one of the considered clinical questions
Stanton <i>et al</i> 1995 <sup>109</sup>	Does not assess one of the considered clinical questions
Sullivan <i>et al</i> 2004 <sup>110</sup>	Does not assess one of the considered clinical questions
Taylor <i>et al</i> 1999 <sup>111</sup>	Only included women from urban areas
Taylor <i>et al</i> 2003 <sup>112</sup>	No results by residential location of women or for rural women
Thewes <i>et al</i> 2003 <sup>113</sup>	Review
Thiruvarudchelvan <i>et al</i> 2010 <sup>114</sup>	Does not assess one of the considered clinical questions
Turnbull <i>et al</i> 1994 <sup>115</sup>	Does not assess one of the considered clinical questions
Villanueva <i>et al</i> 2008 <sup>116</sup>	No results by residential location of women or for rural women
Ward <i>et al</i> 2000 <sup>117</sup>	Does not assess one of the considered clinical questions
Weller 1998 <sup>118</sup>	Not breast cancer
Whitfield <i>et al</i> 2012 <sup>119</sup>	No information by patient's residential location; only by treatment centre location
Wilcoxon <i>et al</i> 2011 <sup>120</sup>	No results specifically for female breast cancer patients
Willis 2004 <sup>121</sup>	Looks at women outside the target age group for screening
Willis & Baxter 2003 <sup>122</sup>	Looks at women outside the target age group for screening
Winefield <i>et al</i> 2004 <sup>123</sup>	Does not assess one of the considered clinical questions
Wong <i>et al</i> 2014 <sup>124</sup>	No results by residential location of women or for rural women
Woods <i>et al</i> 2010 <sup>125</sup>	A comparative study across countries only
Yelland <i>et al</i> 1991 <sup>126</sup>	No results by residential location of women or for rural women
Youl <i>et al</i> 2011 <sup>127</sup>	Study protocol
Yu <i>et al</i> 2006 <sup>128</sup>	Does not assess one of the considered clinical questions
Zardawi <i>et al</i> 1999 <sup>129</sup>	Does not assess one of the considered clinical questions
Zilliacus <i>et al</i> 2010 <sup>130</sup>	Genetic counselling



## References

1. Achat H, Close G, Taylor R. Who has regular mammograms? Effects of knowledge, beliefs, socioeconomic status, and health-related factors. *Prev Med* 2005;41(1):312-20.
2. Andreeva VA, Pokhrel P. Breast cancer screening utilization among Eastern European immigrant women worldwide: A systematic literature review and a focus on psychosocial barriers. *Psychooncology* 2013;22(12):2664-75.
3. Azzopardi J, Walsh D, Chong C, et al. Surgical treatment for women with breast cancer in relation to socioeconomic and insurance status. *Breast J* 2014;20(1):3-8.
4. Banks E, Byles JE, Gibson RE, et al. Is psychological distress in people living with cancer related to the fact of diagnosis, current treatment or level of disability? Findings from a large Australian study. *Med J Aust* 2010;193(5 Suppl):S62-68.
5. Banks P, Matheson LM, Morrissy K, et al. Characteristics of cancer diagnoses and staging in South Western Victoria: A rural perspective. *Aust J Rural Health* 2014;22(5):257-63.
6. Barratt A, Cockburn J, Furnival C, et al. Perceived sensitivity of mammographic screening: women's views on test accuracy and financial compensation for missed cancers. *J Epidemiol Community Health* 1999;53(11):716-20.
7. Beckmann KR, Buckingham J, Craft P, et al. Clinical characteristics and outcomes of bilateral breast cancer in an Australian cohort. *Breast* 2011;20(2):158-64.
8. Bell RJ, Lijovic M, Fradkin P, et al. Lack of knowledge of hormone receptor status and use of endocrine therapy in invasive breast cancer. *Journal of Women's Health (15409996)* 2009;18(12):1975-80.
9. Bessen T, Chen G, Street J, et al. What sort of follow-up services would Australian breast cancer survivors prefer if we could no longer offer long-term specialist-based care? A discrete choice experiment. *Br J Cancer* 2014;110(4):859-67.
10. Bessen T, Karnon J. A patient-level calibration framework for evaluating surveillance strategies: A case study of mammographic follow-up after early breast cancer. *Asia Pac J Clin Oncol* 2014;10:95.
11. Boyages J, Jayasinghe UW, Coombs N. Multifocal breast cancer and survival: Each focus does matter particularly for larger tumours. *Eur J Cancer* 2010;46(11):1990-96.
12. Brennan ME, Spillane AJ. Uptake and predictors of post-mastectomy reconstruction in women with breast malignancy--systematic review. *Eur J Surg Oncol* 2013;39(6):527-41.
13. Brennan ME, Houssami N. Image-detected 'probably benign' breast lesions: A significant reason for referral from primary care. *Breast* 2006;15(5):683-86.
14. Brennan ME, Gormally JF, Butow P, et al. Survivorship care plans in cancer: a systematic review of care plan outcomes. *Br J Cancer* 2014;111(10):1899-908.
15. Brennan ME, Butow P, Spillane AJ, et al. Survivorship care after breast cancer: follow-up practices of Australian health professionals and attitudes to a survivorship care plan. *Asia Pac J Clin Oncol* 2010;6(2):116-25.
16. Brennan ME, Butow P, Marvan M, et al. Survivorship care after breast cancer treatment - Experiences and preferences of Australian women. *Asia Pac J Clin Oncol* 2010;6:159.
17. Brennan M, Butow P, Spillane AJ, et al. Follow up after breast cancer: Views of Australian women. *Aust Fam Physician* 2011;40(5):311-16.
18. Brennan ME, Butow P, Marven M, et al. Survivorship care after breast cancer treatment - Experiences and preferences of Australian women. *Breast* 2011;20(3):271-77.

19. Brown SL, Gibney TM, Tarling R. Busy lifestyles and mammography screening: time pressure and women's reattendance likelihood. *Psychol Health* 2013;28(8):928-38.
20. Buckley E, Sullivan T, Farshid G, et al. Atypical hyperplasia as a risk factor for subsequent invasive or in situ breast cancer. *Eur J Cancer* 2014;50:S121.
21. Budden LM, Hayes BA, Pierce PF, et al. Australian women's prediagnostic values and influencing sociodemographic variables relating to treatment choices for early breast cancer treatment. *Australian Journal of Cancer Nursing* 2007;8(1):9-20.
22. Budden LM, Pierce PF, Hayes BA, et al. Australian women's prediagnostic decision-making styles, relating to treatment choices for early breast cancer treatment. *Res Theory Nurs Pract* 2003;17(2):117-36.
23. Butler-Henderson K, Lee AH, Lenzo NP, et al. Epidemiology of ductal carcinoma in situ in Western Australia: implications for surgical margins and management. *Breast Cancer* 2014.
24. Canfell K. Progress in cancer screening: Where are we in 2014? *Cancer Forum* 2014;38(3):191-96.
25. Carrick SE, Bonevski B, Redman S, et al. Surgeons' opinions about the NHMRC clinical practice guidelines for the management of early breast cancer. *Med J Aust* 1998;169(6):300-5.
26. Chavez-Macgregor M, Hortobagyi GN. Cancer survival in Australia, Canada, Denmark, Norway, Sweden, and the UK, 1995-2007 (the International Cancer Benchmarking Partnership): An analysis of population-based cancer registry data. *Breast Diseases* 2011;22(3):262-63.
27. Chin YS, Browne L, Graham PH. Breast conservation for ductal carcinoma in situ: Results at an Australian institution with evidence to recommend prospective assessment of the utility of a lumpectomy boost. *Asia Pac J Clin Oncol* 2008;4(3):137-42.
28. Chisholm J, Donoghue J, Dunn K, et al. A comparison of the awareness and utilisation of postoperative health services provided to women with breast cancer in public and private hospitals. *Aust Health Rev* 2000;23(2):113-22.
29. Clarke PM. Cost-benefit analysis and mammographic screening: a travel cost approach. *J Health Econ* 1998;17(6):767-87.
30. Clarke PM. Testing the convergent validity of the contingent valuation and travel cost methods in valuing the benefits of health care. *Health Econ* 2002;11(2):117-27.
31. Clover K, Redman S, Forbes J, et al. Two sequential randomized trials of community participation to recruit women for mammographic screening. *Prev Med* 1996;25(2):126-34.
32. Cockburn J, Hill D, Irwig L, et al. Development and validation of an instrument to measure satisfaction of participants at breast screening programmes. *Eur J Cancer* 1991;27(7):827-31.
33. Cockburn J, Schofield P, White V, et al. Predictors of returning for second round screening at a population based mammographic screening programme in Melbourne, Australia. *J Epidemiol Community Health* 1997;51(1):62-6.
34. Coleman MP, Forman D, Bryant H, et al. Cancer survival in Australia, Canada, Denmark, Norway, Sweden, and the UK, 1995-2007 (the International Cancer Benchmarking Partnership): an analysis of population-based cancer registry data. *Lancet* 2011;377(9760):127-38.
35. Coleman MP, Quaresma M, Berrino F, et al. Cancer survival in five continents: a worldwide population-based study (CONCORD). *The Lancet Oncology* 2008;9(8):730-56.
36. Craft PS, Buckingham JM, Dahlstrom JE, et al. Variation in the management of early breast cancer in rural and metropolitan centres: implications for the organisation of rural cancer services. *Breast* 2010;19(5):396-401.
37. Cramb SM, Garvey G, Valery PC, et al. The first year counts: Cancer survival among Indigenous and non-Indigenous Queenslanders, 1997-2006. *Med J Aust* 2012;196(4):270-74.



38. Cramb SM, Mengersen KL, Baade PD. Identification of area-level influences on regions of high cancer incidence in Queensland, Australia: a classification tree approach. *BMC Cancer* 2011;11:311.
39. Crombie K, Hancock K, Chang E, et al. Breast screening education at Australian and Thai worksites: a comparison of program effectiveness. *Contemporary Nurse: A Journal for the Australian Nursing Profession* 2005;19(1-2):181-96.
40. Davey HM, Barratt AL, Butow PN, et al. The impact of different criteria for selecting information to be provided to women undergoing diagnostic breast tests. *Patient Educ Couns* 2008;71(1):86-94.
41. Delpizzo V. Imprecise exposure assessment and the sample size requirements of case-control studies of residential magnetic field exposure and cancer in adults. *Bioelectromagnetics* 1995;16(2):132-42.
42. Dowling A, Henderson M, Saunders C, et al. Circulating tumour cells in early stage breast cancer the empathy breast cancer network. *Asia Pac J Clin Oncol* 2014;10:175.
43. Emery J. The potential role of primary care in cancer survivorship. *Asia Pac J Clin Oncol* 2010;6:38.
44. Emery JD, Walter FM, Gray V, et al. Diagnosing cancer in the bush: a mixed methods study of GP and specialist diagnostic intervals in rural Western Australia. *Fam Pract* 2013;30(5):541-50.
45. Fisher A, Juraskova I, Butow P, et al. not just following what doctors say: Piloting of a decision aid for women considering participation in the sentinel node biopsy versus axillary clearance 2 (SNAC2) trial. *Asia Pac J Clin Oncol* 2014;10:107.
46. Fong A, Shafiq J, Saunders C, et al. A comparison of systemic breast cancer therapy utilization in Canada (British Columbia), Scotland (Dundee), and Australia (Western Australia) with models of "optimal" therapy. *Breast* 2012;21(4):562-69.
47. Fong A, Shafiq J, Saunders C, et al. A comparison of surgical and radiotherapy breast cancer therapy utilization in Canada (British Columbia), Scotland (Dundee), and Australia (Western Australia) with models of "optimal" therapy. *Breast* 2012;21(4):570-7.
48. Frensham LJ, Zarnowiecki DM, Parfitt G, et al. The experiences of participants in an innovative online resource designed to increase regular walking among rural cancer survivors: a qualitative pilot feasibility study. *Support Care Cancer* 2014;22(7):1923-29.
49. Furnival C. Access to breast-conserving treatment: are surgeons responsible? *ANZ J Surg* 2004;74(6):402-3.
50. Furnival CM. Breast cancer in rural Australia. *Med J Aust* 1997;166(1):25-6.
51. Giles C, Marr G, Zorbas H. Shared follow-up care for early breast cancer - A new model of care. *Asia Pac J Clin Oncol* 2010;6:112.
52. Goldsbury DE, Armstrong K, Simonella L, et al. Using administrative health data to describe colorectal and lung cancer care in New South Wales, Australia: a validation study. *BMC Health Serv Res* 2012;12:387.
53. Green T, Zarate D, Colquist S, et al. Patterns of mastectomy for invasive breast cancer in Queensland. *Asia Pac J Clin Oncol* 2013;9:88.
54. Halkett G, O'Connor M, Aranda S, et al. Protocol for the RT Prepare Trial: A multiple-baseline study of radiation therapists delivering education and support to women with breast cancer who are referred for radiotherapy. *BMJ Open* 2014;4(8).
55. Halkett G, Arbon P, Scutter S, et al. The role of the breast care nurse during treatment for early breast cancer: the patient's perspective. *Contemporary Nurse: A Journal for the Australian Nursing Profession* 2006;23(1):46-57.
56. Harden H, Colquist S, Walpole E, et al. Queensland cancer quality index: Tracking queensland's progress in improving cancer care. *Asia Pac J Clin Oncol* 2014;10:147.

57. Harrison JD, Choy ET, Spillane A, et al. Australian breast cancer specialists' involvement in multidisciplinary treatment planning meetings. *Breast* 2008;17(4):335-40.
58. Hayes SC, Rye S, Battistutta D, et al. Upper-body morbidity following breast cancer treatment is common, may persist longer-term and adversely influences quality of life. *Health Qual Life Outcomes* 2010;8:92.
59. Heathcote K, Armstrong B. Disparities in cancer outcomes in regional and rural Australia. *Cancer Forum* 2007;31(2):70-4.
60. Hersch J, Barratt A, Jansen J, et al. The effect of information about overdetection of breast cancer on women's decision-making about mammography screening: Study protocol for a randomised controlled trial. *BMJ Open* 2014;4(5).
61. Heywood A, Sanson-Fisher R, Ring I, et al. Risk prevalence and screening for cancer by general practitioners. *Prev Med* 1994;23(2):152-9.
62. Hunt RW, Fazekas BS, Luke CG, et al. Where patients with cancer die in South Australia, 1990-1999: A population-based review. *Med J Aust* 2001;175(10):526-29.
63. Hyndman JC, Holman CD. Differential effects on socioeconomic groups of modelling the location of mammography screening clinics using Geographic Information Systems. *Aust N Z J Public Health* 2000;24(3):281-6.
64. Hyndman J, Holman CD, Jamrozik K. The effect of spatial definition on the allocation of clients to screening clinics. *Soc Sci Med* 1997;45(2):331-40.
65. Ingram DM, McEvoy SP, Byrne MJ, et al. Surgical caseload and outcomes for women with invasive breast cancer treated in Western Australia. *Breast* 2005;14(1):11-7.
66. Jones SC. Coverage of breast cancer in the Australian print media--does advertising and editorial coverage reflect correct social marketing messages? *J Health Commun* 2004;9(4):309-25.
67. Jong KE, Vale PJ, Armstrong BK. Rural inequalities in cancer care and outcome. *Med J Aust* 2005;182(1):13-14.
68. Kavanagh AM, Mitchell H, Farrugia H, et al. Monitoring interval cancers in an Australian mammographic screening programme. *J Med Screen* 1999;6(3):139-43.
69. Kiely BE, McCaughan G, Christodoulou S, et al. Using scenarios to explain life expectancy in advanced cancer: attitudes of people with a cancer experience. *Support Care Cancer* 2013;21(2):369-76.
70. Kiely BE, Jenkins MA, McKinley JM, et al. Contralateral risk-reducing mastectomy in BRCA1 and BRCA2 mutation carriers and other high-risk women in the Kathleen Cuninghame Foundation Consortium for Research into Familial Breast Cancer (kConFab). *Breast Cancer Res Treat* 2010;120(3):715-23.
71. Kremser T, Evans A, Moore A, et al. Use of complementary therapies by Australian women with breast cancer. *Breast* 2008;17(4):387-94.
72. Kricker A. Issues in breast cancer screening in Australia. *Cancer Forum* 1998;22(1):11-15.
73. Kricker A, Newman B, Gertig DM, et al. Why do large breast cancers still present in a population offered screening? *Int J Cancer* 2008;123(12):2907-14.
74. Kricker A, Price M, Butow P, et al. Effects of life event stress and social support on the odds of a  $\geq 2$  cm breast cancer. *Cancer Causes Control* 2009;20(4):437-47.
75. Kwok C, White K. Cultural and linguistic isolation: The breast cancer experience of Chinese-Australian women--A qualitative study. *Contemporary Nurse: A Journal for the Australian Nursing Profession* 2011;39(1):85-94.
76. Lawler S, Spathonis K, Masters J, et al. Transition to follow-up care after breast cancer treatment in rural Australia: Women's experiences of service provision. *Asia Pac J Clin Oncol* 2012;8:240.

77. Llewellyn G, Balandin S, Poulos A, et al. Disability and mammography screening: intangible barriers to participation. *Disabil Rehabil* 2011;33(19-20):1755-67.
78. Lobb EA, Butow PN, Meiser B, et al. Tailoring communication in consultations with women from high risk breast cancer families. *Br J Cancer* 2002;87(5):502-8.
79. Lopez PJT, Albero JS, Rodriguez-Montes JA. Is it possible to reduce the incident of colorectal cancer by modifying diet and lifestyle? *Curr Cancer Ther Rev* 2013;9(3):157-63.
80. Lu CY, Srasuebkul P, Drew AK, et al. Trastuzumab therapy in Australia: which patients with HER2+ metastatic breast cancer are assessed for cardiac function? *Breast* 2013;22(4):482-7.
81. Luke C, Priest K, Roder D. Changes in incidence of in situ and invasive breast cancer by histology type following mammography screening. *Asian Pac J Cancer Prev* 2006;7(1):69-74.
82. Luke C, Chapman P, Priest K, et al. Use of radiotherapy in the primary treatment of cancer in South Australia. *Australas Radiol* 2003;47(2):161-7.
83. Magiros M, Norgrove JM, Arvin MP, et al. Women's access to resources about early breast cancer. *Med J Aust* 2001;174(12):664-5.
84. Marsh CJ, Boulton M, Wang JX, et al. National Breast Cancer Audit: the use of multidisciplinary care teams by breast surgeons in Australia and New Zealand. *Med J Aust* 2008;188(7):385-8.
85. Mauad EC, Nicolau SM, Moreira LF, et al. Adherence to cervical and breast cancer programs is crucial to improving screening performance. *Rural Remote Health* 2009;9(3):1241.
86. McCredie M, Hopper JL, Cawson JN. Risk factors and preventive strategies for breast cancer. *Med J Aust* 1995;163(8):435-37,39-40.
87. McMichael C, Kirk M, Manderson L, et al. Indigenous women's perceptions of breast cancer diagnosis and treatment in Queensland. *Aust N Z J Public Health* 2000;24(5):515-19.
88. Moorin RE, Holman CD. The effects of socioeconomic status, accessibility to services and patient type on hospital use in Western Australia: a retrospective cohort study of patients with homogenous health status. *BMC Health Serv Res* 2006;6:74.
89. Moran S, Warren-Forward H. A retrospective study of the performance of radiographers in interpreting screening mammograms. *Radiography* 2011;17(2):126-31.
90. Morley KI, Milne RL, Giles GG, et al. Socio-economic status and survival from breast cancer for young, Australian, urban women. *Aust N Z J Public Health* 2010;34(2):200-5.
91. Morrell S, Taylor R, Roder D, et al. Mammography screening and breast cancer mortality in Australia: an aggregate cohort study. *J Med Screen* 2012;19(1):26-34.
92. Ogunsiji O, Wilkes L, Peters K, et al. Knowledge, attitudes and usage of cancer screening among West African migrant women. *J Clin Nurs* 2013;22(7/8):1026-33.
93. Paddison JS, Yip MJ. Exploratory study examining barriers to participation in colorectal cancer screening. *Aust J Rural Health* 2010;18(1):11-5.
94. Page A, Morrell S, Chiu C, et al. Recruitment to mammography screening: A randomised trial and meta-analysis of invitation letters and telephone calls. *Aust N Z J Public Health* 2006;30(2):111-18.
95. Peters K. Politics and patriarchy: Barriers to health screening for socially disadvantaged women. *Contemporary Nurse: A Journal for the Australian Nursing Profession* 2012;42(2):190-97.
96. Protani M, Page A, Taylor R, et al. Breast cancer risk factors in Queensland women attending population-based mammography screening. *Maturitas* 2012;71(3):279-86.
97. Richardson G. Challenges of treating patients with cancer in Australia. *Ann Oncol* 2013;24:ix9.
98. Roder D, De Silva P, Kollias J, et al. A study of the predictors of survival from breast cancers managed by Australian surgeons participating in the national breast cancer audit of the royal Australasian college of surgeons. *Asia Pac J Clin Oncol* 2011;7:169-70.

99. Rychetnik L, Carter SM, Abelson J, et al. Enhancing citizen engagement in cancer screening through deliberative democracy. *JNCI: Journal of the National Cancer Institute* 2013;105(6):380-86.
100. Sandelin K, King E, Redman S. Breast reconstruction following mastectomy: current status in Australia. *ANZ J Surg* 2003;73(9):701-6.
101. Sharplin G, Bannister S, Eckert M, et al. A South Australian cancer atlas shows important variations in cancer risk and outcomes, but can better use be made of Australian data to support the work of cancer councils? *Cancer Forum* 2014;38(2):143-49.
102. Shugg D, White VM, Kitchen PR, et al. Surgical management of ductal carcinoma in situ in Australia in 1995. *ANZ J Surg* 2002;72(10):708-15.
103. Smith T. A long way from home: Access to cancer care for rural Australians. *Radiography* 2012;18(1):38-42.
104. Somogyi RB, Webb A, Baghdikian N, et al. Understanding the factors that influence breast reconstruction decision making in Australian women. *Breast* 2015.
105. Speedy S, Hase S. Health beliefs and perceptions of women presenting or not presenting for mammographic screening in a rural health setting. *Aust J Rural Health* 2000;8(4):208-13.
106. Spillane AJ, Littlejohn D, Wong S, et al. Australia's breast surgery workload is changing: comparison of a metropolitan and a rural hospital. *Aust N Z J Surg* 1999;69(3):178-82.
107. Spillane AJ, Kennedy CW, Gillett DJ, et al. Screen-detected breast cancer compared to symptomatic presentation: an analysis of surgical treatment and end-points of effective mammographic screening. *ANZ J Surg* 2001;71(7):398-402.
108. Spilsbury K, Semmens JB, Saunders CM, et al. Subsequent surgery after initial breast conserving surgery: a population based study. *ANZ J Surg* 2005;75(5):260-4.
109. Stanton WR, Fisher KJ, Balanda KP, et al. Patient reports of health education activities in a public hospital. *Aust Health Rev* 1995;18(2):85-100.
110. Sullivan SG, Slack-Smith LM, Hussain R. Understanding the use of breast cancer screening services by women with intellectual disabilities. *Soz Präventivmed* 2004;49(6):398-405.
111. Taylor R, Stubbs JM, Langlands AO, et al. Predictors of mastectomy for women with breast cancer in the greater western region of sydney. *Breast Journal* 1999;5(2):116-21.
112. Taylor R, Davis P, Boyages J. Long-term survival of women with breast cancer in New South Wales. *Eur J Cancer* 2003;39(2):215-22.
113. Thewes B, Meiser B, Tucker K, et al. Screening for psychological distress and vulnerability factors in women at increased risk for breast cancer: a review of the literature. *Psychol Health Med* 2003;8(3):289-304.
114. Thiruvavurchelvan A, Hamilton A, Fenton G, et al. 5 year outcomes of the breast and ovarian cancer risk management clinic at the Royal Prince Alfred hospital. *Asia Pac J Clin Oncol* 2010;6:227.
115. Turnbull D, Irwig L, Simpson JM, et al. The psychosocial impact of implementing a mammography screening campaign in an Australian community. *Soc Sci Med* 1994;39(4):543-51.
116. Villanueva EV, Jones S, Nehill C, et al. The 2003 Australian Breast Health Survey: survey design and preliminary results. *BMC Public Health* 2008;8:13.
117. Ward J, Rikard-Bell G, Hobbs M. Improving local services for women with breast cancer: interviews with general practitioners in central Sydney. *Aust Health Rev* 2000;23(2):123-33.
118. Weller D. Colorectal cancer screening in Australia - Where to now? *Cancer Forum* 1998;22(1):15-18.
119. Whitfield R, Kollias J, De Silva P, et al. Use of trastuzumab in Australia and New Zealand: results from the National Breast Cancer Audit. *ANZ J Surg* 2012;82(4):234-39.

120. Wilcoxon H, Luxford K, Saunders C, et al. Multidisciplinary cancer care in Australia: A national audit highlights gaps in care and medico-legal risk for clinicians. *Asia Pac J Clin Oncol* 2011;7(1):34-40.
121. Willis K. Personal choice/social responsibility: women aged 40-49 years and mammography screening. *Journal of Sociology* 2004;40(2):121-36.
122. Willis K, Baxter J. Trusting technology: women aged 40-49 years participating in screening for breast cancer--an exploratory study. *Aust N Z J Public Health* 2003;27(3):282-6.
123. Winefield HR, Coventry BJ, Lambert V. Setting up a health education website: Practical advice for health professionals. *Patient Educ Couns* 2004;53(2):175-82.
124. Wong A, Snook K, Brennan M, et al. Increasing breast reconstruction rates by offering more women a choice. *ANZ J Surg* 2014;84(1-2):31-36.
125. Woods LM, Rachet B, O'Connell DL, et al. Differences in breast cancer incidence in Australia and England by age, extent of disease and deprivation status: women diagnosed 1980-2002. *Aust N Z J Public Health* 2010;34(2):206-13.
126. Yelland MJ, Rice DE, Ward AE, et al. A profile of Australian women practicing breast self-examination. *Asia Pac J Public Health* 1991;5(4):307-12.
127. Youl PH, Baade PD, Aitken JF, et al. A multilevel investigation of inequalities in clinical and psychosocial outcomes for women after breast cancer. *BMC Cancer* 2011;11.
128. Yu XQ, O'Connell DL, Gibberd RW, et al. Trends in survival and excess risk of death after diagnosis of cancer in 1980-1996 in New South Wales, Australia. *Int J Cancer* 2006;119(4):894-900.
129. Zardawi IM, Hearnden F, Meyer P, et al. Ultrasound-guided fine needle aspiration cytology of palpable breast lesions in a rural setting. Comparison of cytology with imaging and final outcome. *Acta Cytol* 1999;43(2):163-8.
130. Zilliacus E, Meiser B, Lobb E, et al. The virtual consultation: practitioners' experiences of genetic counseling by videoconferencing in Australia. *Telemed J E Health* 2010;16(3):350-7.





# PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
<b>TITLE</b>			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
<b>ABSTRACT</b>			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
<b>INTRODUCTION</b>			
Rationale	3	Describe the rationale for the review in the context of what is already known.	4
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	5, Table 1
<b>METHODS</b>			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	NR
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	5-6
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	5
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Supplementary file 1
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	6-7
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	7
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	NR
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	6
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	NR
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., $I^2$ ) for each meta-analysis.	7



# PRISMA 2009 Checklist

Page 1 of 2

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	6
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	NR
<b>RESULTS</b>			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	7, Figure 1
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	Tables 2-6
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	7-8, Tables 2-6
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	8-12, Tables 2-6
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	NR
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	NR
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	NR
<b>DISCUSSION</b>			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	12-13
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	14
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	15
<b>FUNDING</b>			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	16





# PRISMA 2009 Checklist

doi:10.1371/journal.pmed1000097

For more information, visit: [www.prisma-statement.org](http://www.prisma-statement.org).

Page 2 of 2

For peer review only

# BMJ Open

## Variations in outcomes by residential location for women with breast cancer: a systematic review

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2017-019050.R1
Article Type:	Research
Date Submitted by the Author:	14-Dec-2017
Complete List of Authors:	Dasgupta, Paramita; Cancer Council Queensland, Cancer Research Centre Baade, Peter; Cancer Council Queensland, Cancer Research Centre Youlden, Danny; Cancer Council Queensland, Cancer Research Centre Garvey, Gail; Menzies School of Health Research, Epidemiology and Health Systems Aitken, Joanne; Cancer Council Queensland, Cancer Research Centre Wallington, Isabella; Cancer Australia Chynoweth, Jennifer; Cancer Australia Zorbas, Helen; Cancer Australia Youl, Philippa; Cancer Council Queensland, Cancer Research Centre
<b>Primary Subject Heading</b>:	Epidemiology
Secondary Subject Heading:	Oncology
Keywords:	Breast tumours < ONCOLOGY, EPIDEMIOLOGY, PUBLIC HEALTH

SCHOLARONE™  
Manuscripts

**Variations in outcomes by residential location for women with breast cancer: a systematic review**

Paramita Dasgupta<sup>1</sup>, Peter D Baade<sup>1,2,3, §</sup>, Danny Youlden<sup>1</sup>, Gail Garvey<sup>4</sup>, Joanne F Aitken<sup>1,5,6</sup>, Isabella Wallington<sup>7</sup>, Jennifer Chynoweth<sup>7</sup>, Helen Zorbas<sup>7</sup>, Philippa H Youl<sup>1,2,5</sup>

<sup>1</sup>Cancer Research Centre, Cancer Council Queensland, Brisbane, Australia

<sup>2</sup>Menzies Health Institute Queensland, Griffith University, Gold Coast Campus, Parklands Drive, Southport QLD 4222, Australia

<sup>3</sup>School of Mathematical Sciences, Queensland University of Technology, Gardens Point, Brisbane QLD 4000, Australia

<sup>4</sup>Menzies School of Health Research, Brisbane Queensland, Australia

<sup>5</sup>School of Public Health and Social Work, Queensland University of Technology, Herston Road, Kelvin Grove QLD 4059, Australia

<sup>6</sup>Institute for Resilient Regions, University of Southern Queensland, Toowoomba, Australia

<sup>7</sup>Cancer Australia, Sydney, New South Wales, Australia

§ Corresponding Author: Prof Peter D Baade, Senior Research Fellow  
Cancer Council Queensland, PO Box 201, Spring Hill QLD 4001 Australia  
Email: peterbaade@cancerqld.org.au  
Fax: +61 7 3259 8527; Phone: +61 7 3634 5317

Authors Email addresses:

PY: philippa.youl@qut.edu.au  
PD: paramitadasgupta@cancerqld.org.au  
PB: peterbaade@cancerqld.org.au  
DY: dannyoulden@cancerqld.org.au  
GG: gail.garvey@menzies.edu.au  
JA: joanneaitken@cancerqld.org.au  
IW: Isabella.Wallington@canceraustralia.gov.au  
JC: Jennifer.Chynoweth@canceraustralia.gov.au  
HZ: Helen.Zorbas@canceraustralia.gov.au

Word length:

Manuscript word count (excluding title page, abstract, references, figure legends, and tables): 4964  
Abstract word count: 287  
References: 142  
Tables: 6  
Figures: 1  
Supplementary files: 4

## Abstract

**Objectives:** To systematically assess the evidence for variations in outcomes at each step along the breast cancer continuum of care for Australian women by residential location.

**Design:** Systematic review

**Methods:** Systematic searches of peer-reviewed articles in English published from 1/1/1990 to 24/11/2017 using PubMed, EMBASE, CINAHL and Informit databases. Inclusion criteria were: population was adult female breast cancer patients; Australian setting; outcome measure was survival, patient or tumour characteristics, screening rates or frequencies, clinical management, patterns of initial care or post-treatment follow-up with analysis by residential location, or studies involving non-metropolitan women only. Included studies were critically appraised using a modified Newcastle-Ottawa Scale.

**Results:** Seventy-four quantitative studies met the inclusion criteria. Around 59% were considered high quality, 34% moderate and 7% low. No eligible studies examining treatment choices or post-treatment follow-up were identified. Non-metropolitan women consistently had poorer survival, with most of this differential being attributed to more advanced disease at diagnosis, treatment-related factors and socioeconomic disadvantage. Compared to metropolitan women, non-metropolitan women were more likely to live in disadvantaged areas and had differing clinical management and patterns of care. However, findings regarding geographical variations in tumour characteristics or diagnostic outcomes were inconsistent.

**Conclusions:** A general pattern of poorer survival and variations in clinical management for Australian female breast cancer patients from non-metropolitan areas was evident. However, the wide variability in data sources, measures, study quality, time periods and geographical classification made direct comparisons across studies challenging. The review highlighted the need to promote standardization of geographical classifications and increased comparability of data systems. It also identified key gaps in the existing literature including a lack of studies on advanced breast cancer, geographical variations in treatment choices from the perspective of patients and post-treatment follow-up.

**Keywords:** Breast cancer; Non-metropolitan; Systematic review; Geographical variations; Continuum of care

**Strengths and Limitations:**

Strengths:

- First systematic review examining evidence for geographical variations in breast cancer outcomes across the continuum of care for Australian women
- Review was conducted according to published guidelines
- All included articles were subject to quality assessment

Limitations:

- Wide heterogeneity across studies in study quality, levels of evidence, methodology, data sources, time period and terminology
- No meta-analysis was possible

## Introduction

Worldwide, breast cancer is the most frequently diagnosed cancer among females, accounting for 25% of all new diagnoses in 2012 and is the leading cause of female cancer mortality (15% of total cancer deaths).<sup>1</sup> Among Australian women, breast cancer is also the most common cancer and the second leading cause of cancer mortality.<sup>2</sup> Like other developed countries, Australia has high breast cancer incidence rates but relatively low mortality rates<sup>1</sup> with significant and ongoing improvements in survival, most likely due to earlier detection, screening mammography and improved treatments.<sup>3</sup> However not all women have benefitted equally from these improvements with international studies consistently reporting geographical variations in survival<sup>4-6</sup> and across the breast cancer continuum of care (such as screening, diagnosis, treatment, post-treatment and psychosocial care).<sup>7-9</sup> While Australia has relatively high survival rates compared to international benchmarks,<sup>10</sup> significant variations exist with poorer survival for rural and disadvantaged women.<sup>11 12</sup>

Australia has a universal health-care system, however it is also a country of vast distances with cancer-related services typically being concentrated in major cities<sup>13</sup> so that those living elsewhere often face long travel times and limited access to specialized care.<sup>11 14</sup> Although about 20% of the total Australian population live outside a major city, for some states and territories this percentage increases to over a third.<sup>15</sup> There is also considerable overlap between remoteness and socioeconomic status; around a third of the population living in major cities in Australia also live in areas classified as least disadvantaged, compared to only 2% of those from very remote areas.<sup>16</sup> Current strategies to better address the needs of rural cancer patients and to make cancer care more accessible include the Australian Government's establishment of cancer centres and radiation facilities in regional Australia, exploring innovative models of care and other local-level initiatives.<sup>14 17</sup>

A comprehensive understanding of the drivers of variations in outcomes across population groups is a prerequisite for ensuring equitable cancer care and improving outcomes for all Australians. This systematic review aimed to identify, assess and synthesize the current evidence relating to geographical variations in survival, patient and tumor characteristics, diagnostic and clinical outcomes for female Australian breast cancer patients. It was conducted as part of a larger systematic review that also investigated psycho-social outcomes<sup>18</sup> and variations by Indigenous status.<sup>19</sup> Such a review may help identify gaps in knowledge, formulate strategic research priorities and develop evidence-based interventions to reduce the observed inequities.

## Methods

### Terminology

Due to the range of definitions used to define geographical areas, geographical remoteness was categorised into “metropolitan” areas (typically “major cities” or “urban”) and “non-metropolitan” areas (comprising the remaining localities). However, where relevant, important patterns observed within the remoteness categories were described in greater detail such as studies relating specifically to remote or very remote areas.

**Clinical Questions**

The published PRISMA guidelines for conducting systematic reviews<sup>20</sup> were followed for this review. As a first step, a series of clinical questions to guide the review were clearly defined and agreed upon before commencing the review process in consultation with a Project Steering Group that included clinicians, researchers, allied health practitioners, consumer advocates with experience in breast cancer and health policy representatives. All questions conformed to PICO guidelines<sup>20</sup> in which the target population (P), intervention/exposure (I), comparator (C) and outcomes (O) are clearly defined and used to guide the review process, with the comparator being the only optional component.<sup>21</sup>

Eleven clinical questions examining variations between non-metropolitan and metropolitan women with breast cancer (collectively referred to as ‘residential location’) were grouped according to 1) survival (one question); 2) patient/tumour characteristics (two questions); and 3) diagnostic and treatment outcomes (eight questions) (Table 1).

**Literature searches**

The electronic databases: PubMed, EMBASE, CINAHL and Informit were systematically searched for all indexed articles from 1 January 1990 to 24 November 2017. The Web of Science database was used for cited reference searches.

Search strategies were based on keywords and subject headings to reflect the review aim with separate queries designed for each clinical question (see Supplementary Appendix 1). Key terms of ‘breast neoplasms’, ‘female’ and ‘Australia’ were combined with terms relating to geographical aspects including ‘rural health’, ‘geographic inequalities’, ‘spatial’, ‘health services accessibility’ and ‘remoteness’ and outcome measures of interest notably ‘survival’, ‘stage’, ‘diagnosis age’, ‘socioeconomic’, ‘mammography’, ‘screening rate’, ‘re-screening’, ‘clinical management’, ‘patterns of care’, ‘mastectomy’, ‘breast reconstruction’, ‘chemotherapy’, ‘radiotherapy’, ‘lymph node’ and ‘guideline adherence’. Additional synonyms reflecting each of the key terms were also included.

**Inclusion criteria**

Studies were eligible if they met the following inclusion criteria:



- 1) the population included adult female breast cancer patients or focussed on a breast cancer specific sub-group; and
- 2) had an Australian setting; and
- 3) the outcome measure was survival, patient or tumour characteristics, screening participation or frequency, clinical management, patterns of initial care or post-treatment follow-up; and
- 4) was
  - a) a quantitative study on non-metropolitan versus metropolitan comparisons; or
  - b) a qualitative study on geographical inequalities; or
  - c) quantitative or qualitative studies reporting on relevant outcomes for non-metropolitan women only.

The scope of the review was limited to English language peer-reviewed original research articles. Reviews, editorials, books, conference abstracts and commentaries were excluded, although when identified through the systematic searches their reference lists were examined for relevant articles.

## Review process

After removing duplicates, the titles and abstracts of all articles identified during the searches were independently reviewed by two authors (first PD, second PY, DY or PB) for possible inclusion based on their relevance to each clinical question. Discrepancies were clarified through discussion between the two reviewers and if necessary the other reviewers were consulted. Full text versions of all articles of potential relevance were then retrieved for more detailed independent assessment by two reviewers as before. During this process articles were classified as “include” or “exclude” with reasons for exclusion being documented. Reviewer decisions were compared and any disagreements resolved by consensus.

## Critical appraisal

The quality of all included articles was critically assessed by two independent reviewers using the Newcastle-Ottawa Scale (NOS),<sup>22</sup> a risk of bias assessment tool for non-randomised studies recommended by the Cochrane Collaboration<sup>23</sup> that can be readily tailored for the critical appraisal of quantitative cohort studies.<sup>9</sup> The NOS assesses studies on six items over five broad perspectives: (a) selection bias; (b) measurement of confounders; (c) outcome assessment; (d) follow-up and (e) adjustments for residual confounders (two items). We extended this tool by incorporating features from other published checklists<sup>24 25</sup> to include three additional items to assess (a) study attrition (missing data), (b) statistical methods and (c) data presentation. Studies were scored according to the extent that they met each of the nine assessed criterion (see Supplementary Appendix 2) using an ordinal scale to rate the risk of bias as 0 (high), 1 (intermediate) and 2 (low) and the individual item scores then summed to give a total quality score. Instances of major differences in total scores

between the two reviewers for individual articles were resolved by consensus and each article was then assigned a summary score (averaged across the two scores). The total average score (range of 0-18) achieved across the nine criterion was categorized as “high” (14-18), “moderate” (9-13.5) or “low” (<9) quality. Studies were not excluded based specifically on their quality rating.

Studies were also classified according to the published levels of evidence for quantitative observational studies from the Australian National Health and Medical Research Council (NHMRC)<sup>24</sup> in decreasing order of strength as Level I, Level II, Level III-1, Level III-2, Level III-3 or Level IV.

**Data extraction**

For all included articles, study characteristics including author(s), publication year, title, population, design and outcomes were recorded in a customized database by one reviewer and subsequently checked by another. Any errors or inconsistencies were resolved after consulting the original source.

**Results**

**Study selection**

The steps in the review process are illustrated in a PRISMA diagram (Figure 1). A total of 476 articles were identified across combined databases with an additional 45 citations from other sources. After removing duplicates, an initial pool of 211 articles remained of which 65 were excluded after initial scanning of title/abstracts. Of the 146 retrieved full-text articles, 74 met the inclusion criteria and were considered relevant to at least one of the clinical questions. Excluded studies are listed in Supplementary Appendix 3, including reasons for exclusion.

**Study characteristics**

All included articles were quantitative and around 80% used administrative data sources such as population-based cancer registries, screening databases or the non-representative (not population based) National Breast Cancer Audit database which has collected data on about 60% of invasive early breast cancers treated by participating Australian (and New Zealand) breast surgeons since 1998.<sup>26</sup> Remaining studies were based on medical record reviews and cross-sectional surveys.

There was considerable heterogeneity in the definition of non-metropolitan and metropolitan populations. While more than half (57%) of the included studies used standardized definitions such as the Rural, Remote and Metropolitan Areas (RRMA) system, the Accessibility/Remoteness Index of Australia (ARIA) or ARIA+, or remoteness areas defined by the Australian Standard Geographical Classification,<sup>27</sup> others defined non-metropolitan and metropolitan areas based on distances to services, population density or postcodes. Two studies did not provide detailed information regarding the basis of their geographical classification (Table 2).

1  
2  
3 Around 59% of included studies were graded as high quality, 34% moderate and 7% low quality, with  
4 a mean score of 13.0 and range of 6.5-17.0. Key limiting factors for these scores were that around a  
5 third (30%) of studies did not use a population-based representative sample, while 20% did not adjust  
6 for confounders (including age and socio-demographics). Studies based on reliable and objective data  
7 sources (cancer registries) were limited in their ability to control for clinical and treatment factors.  
8  
9 The use of highly selective or convenience samples and lack of follow-up also reduced study quality.  
10  
11 No studies provided Level I evidence, while more than half (57%) gave Level II evidence, 34% Level  
12 III-3 and 9% Level-IV evidence (Table 2).  
13  
14

## 15 **Key findings**

16  
17 Studies are summarized below (Tables 3-6, also Supplementary Appendix 4) according to clinical  
18 questions within each of the key themes: 1) survival outcomes, 2) patient/tumour characteristics and  
19 3) diagnostic and treatment outcomes. Several studies reported on multiple outcomes. The emphasis is  
20 on whether there was evidence of variations in relevant outcomes by residential location and, if so, the  
21 direction and a quantitative estimate of the magnitude of the effect. Given the considerable  
22 heterogeneity among studies in terms of their quality, levels of evidence, time period and  
23 geographical definitions, we have deliberately interpreted any summary patterns with caution.  
24  
25  
26  
27

## 28 **Survival Outcomes**

29  
30 There was a consistent pattern of significantly poorer survival (in unadjusted analyses) for women in  
31 non-metropolitan areas compared to metropolitan women across 21 (19 high and two moderate  
32 quality) of 22 included studies both nationally<sup>28 29</sup> and at the state-level (Table 3).<sup>30-46</sup> The five-year  
33 unadjusted relative survival for female breast cancers was about 2-5% (absolute) lower for non-  
34 metropolitan than metropolitan women. The one exception was an early high quality study involving  
35 women in New South Wales (diagnosed from 1980-1991) that did not report any survival  
36 differential.<sup>47</sup>  
37  
38  
39  
40

41 However, no geographical differential in survival was evident across 11<sup>29 33 37 38 40-44 47 48</sup> of 20 studies  
42 that also reported survival estimates after adjustment for various combinations of known survival  
43 determinants including demographics, area-level disadvantage, spread of disease, comorbidities and  
44 treatment-related factors. The remaining nine studies<sup>30-32 34-36 39 45 49</sup> all reported poorer survival for  
45 non-metropolitan women even after adjustment.  
46  
47  
48

49 The adjusted results varied according to the combination of variables included in the statistical  
50 models. Six of the seven papers that reported significant differentials after adjusting for a measure of  
51 stage at diagnosis did not consider comorbidities or treatment-related factors.<sup>30 31 34 35 39 45</sup> Of the five  
52 studies that adjusted for treatment-related factors, four reported no evidence of a survival differential<sup>38</sup>  
53  
54  
55

<sup>40-42</sup> while the finding of a significant difference was likely to be limited to women diagnosed prior to the mid-1990s in the remaining study.<sup>32</sup>

Most of the 22 included studies focussed on medium-term survival, with only one<sup>44</sup> following women for longer than five years after their breast cancer diagnosis.

**Patient and Tumour Characteristics**

*Patient characteristics*

Both of the included high quality studies that reported a positive association between area-disadvantage and non-metropolitan residence were based on analysis of 30,299 early invasive female breast cancer cases from the National Breast Cancer Audit (Table 4).<sup>50 51</sup> For example, compared to affluent women, socio-economically disadvantaged women diagnosed with breast cancer were 17 times more likely to live in remote areas (than metropolitan areas)<sup>50</sup> while compared to metropolitan women, those from remote areas were 13 times more likely to live in a disadvantaged rather than more advantaged region.<sup>51</sup>

*Tumour characteristics*

No consistent pattern of variations in tumour characteristics by residential location were evident across the 13 included studies (Table 4). Nationally, one high quality study found that non-metropolitan women were 15% more likely to present with tumours >40mm (versus <30mm)<sup>26</sup> while three state-based high quality studies also reported similar patterns,<sup>52-54</sup> despite using different definitions of advanced disease. However, eight others (four high, four moderate quality) showed no differences<sup>30 40 46 55-59</sup> and one (high quality) that metropolitan women were 11% more likely to present with regional disease than non-metropolitan patients, but equally likely to present with distant tumours.<sup>44</sup>

**Diagnostic and Treatment Outcomes**

Studies described here assessed geographical variations in relation to two broad topics: breast cancer screening (Table 5) and treatment (Table 6). The target group for the two screening questions refers to women aged 50 to 69 who were eligible (at the time of this review) for the free population-based national mammographic program in Australia (BreastScreen Australia).<sup>60</sup>

*Screening rate*

All eight of the included moderate quality studies relate to the publicly funded BreastScreen program, as there were no data available to assess variations in private mammography, and provided mixed results. Analyses of self-reported data for more than 10,000 women nationally found that despite poorer access to mammography services,<sup>61</sup> non-metropolitan women had similar screening rates to

metropolitan women,<sup>61 62</sup> consistent with an earlier cross sectional survey.<sup>63</sup> Two state-based studies however reported higher participation rates in the BreastScreen program for non-metropolitan women.<sup>64 65</sup> In contrast women who lived within 10-20 km of a relocatable BreastScreen service were 43% less likely to have been screened than those residing within 2 km of the service.<sup>66</sup> Another study found that non-metropolitan women in the target age group were 39% more likely to report never having been screened through BreastScreen Australia than metropolitan women.<sup>67</sup> Screening history, perceived breast cancer risk and knowledge about service location were among key predictors of accessing a relocatable screening service in a study involving only 180 non-metropolitan women.<sup>68</sup>

### *Rescreening*

Results were inconsistent across the five included studies, with a dependence on the time period of data collection. One early (moderate quality) study showed that metropolitan women had higher rescreening rates through the national BreastScreen program than non-metropolitan women<sup>67</sup> whereas among four other studies from 1995 onwards, one (moderate quality) study showed no difference in rescreening rates<sup>69</sup> and three studies (two moderate, one high quality) showed that non-metropolitan women had higher rescreening rates.<sup>61 70</sup>

### *Clinical management*

Given there are separate Australian guidelines for clinical management of early<sup>71</sup> and advanced stage breast cancer,<sup>72</sup> the descriptions of variations in clinical management are categorised accordingly.

A consistent pattern of variations in the clinical management of early breast cancer by residential location was evident across 21 (14 high, six moderate, one low quality) of 28 included studies with seven (three high, two moderate, two low) finding no variations.

Among 30,299 cases extracted from the National Breast Cancer Audit database, non-metropolitan women were at least five times more likely to have a mastectomy than metropolitan women<sup>26</sup> while another study using this database reported that the proportion of mastectomies progressively increased with increasing remoteness.<sup>73</sup> Various state-specific studies also reported similar patterns.<sup>74-77</sup> Studies using the National Breast Cancer Audit database found that non-metropolitan women were 6% less likely to undergo breast conserving surgery<sup>50</sup> and that the proportion who had breast conserving surgery decreased progressively with increasing remoteness.<sup>73</sup> Similar findings were evident across six other state-level studies.<sup>40 54 74 78-80</sup> Only three studies reported no differences in surgical patterns by residential location.<sup>81-83</sup>

Two studies based on the National Breast Cancer Audit Database reported that non-metropolitan women were up to 20% less likely to receive adjuvant radiotherapy than metropolitan women.<sup>50 73</sup> Moreover women residing in areas lacking radiotherapy facilities had a higher likelihood (23%) of not

receiving radiotherapy than those from regions with such facilities.<sup>73</sup> Three state-based studies also reported similar patterns.<sup>40 54 84</sup> Findings for other treatment modalities were less consistent with no geographical differentials in receipt of either hormonal therapy<sup>84 85</sup> or chemotherapy,<sup>40 80 84</sup> higher uptake of chemotherapy<sup>50</sup> and lower for hormonal therapy among non-metropolitan women<sup>40</sup> being reported.

Non-metropolitan women were consistently (12-58%) less likely to undergo sentinel node biopsies (SNB),<sup>86-88</sup> or post-mastectomy breast reconstruction<sup>89-92</sup> with only one earlier study reporting no difference in reconstruction rates.<sup>93</sup> They also had a 10% higher risk of unplanned readmissions.<sup>94</sup> However, no geographical variations in axillary node surgery<sup>77 79 83</sup> or access to specialist breast care nurses were evident.<sup>95 96</sup>

Of the seven included studies comprising non-metropolitan women only, one reported that breast care nurses were important in ensuring continuity of care,<sup>97</sup> two found a high level of patient satisfaction with the treatment decision process<sup>98 99</sup> and one found that geographical setting was no impediment to receiving breast conserving surgery or to accessing multidisciplinary care at a single non-metropolitan treatment centre.<sup>100</sup> Among regional women in the state of New South Wales, breast conserving surgical rates increased by 9% after a publicly funded radiotherapy service became available in 2013, compared to earlier years when the only options were a local private or publicly funded out-of-areas service.<sup>101</sup> However, regional women who lived  $\geq 100$ -200 km away (versus  $<100$  km) from a radiotherapy service were twice as likely to have a mastectomy.<sup>102</sup>

The only study examining geographical variations in clinical management for advanced breast cancer found no geographical variations in mastectomy rates among women with metastatic disease.<sup>74</sup>

*Recommended clinical management*

Nine (four high, five moderate quality) of 15 included studies reported geographical variations in guideline-concordant care with non-metropolitan women being less likely to undergo adjuvant radiotherapy,<sup>50 54 73 84</sup> hormonal therapy<sup>40</sup> or sentinel node biopsies<sup>86-88</sup> and more likely to experience longer delays in commencing adjuvant chemotherapy.<sup>56</sup> However the other six studies (two high, two moderate, two low quality) found no significant geographical variations in receipt of recommended care.<sup>77 79 80 83 85 95</sup>

*Referral*

Non-metropolitan women were less likely to be referred to a radiation oncologist,<sup>80</sup> and were more likely to experience delays in assessment by a medical oncologist.<sup>56</sup> Further, in a cross-sectional survey of 70 non-metropolitan women, 42% were referred to another health professional before surgery.<sup>99</sup> All studies were of moderate quality.

International studies have consistently shown geographical variations in access to high volume surgical care<sup>103-105</sup> and provided clear evidence that such care is related to improved breast-cancer survival<sup>104 106</sup> and better concordance with clinical care guidelines.<sup>107 108</sup> Hence eligible studies that described access to high caseload surgeons were also considered for this clinical question. One high-quality study reported that non-metropolitan women were 9% more likely to be treated locally by low caseload surgeons<sup>26</sup> (defined as  $\leq 10$  or  $< 20$  cases/year) with similar findings reported by three other high quality studies.<sup>40 50 78</sup>

### *Treatment completion*

Of the two included studies one found that non-metropolitan women were more likely to complete prescribed chemotherapy than metropolitan women.<sup>56</sup> Another reported that women treated by low caseload surgeons ( $\leq 20$  cases/year) were more likely to decline clinician recommended surgery, radiotherapy or chemotherapy based on data from the National Breast Cancer Audit.<sup>109</sup>

The review did not identify any studies examining geographical variations in the specific treatment options offered to non-metropolitan and metropolitan Australian female breast cancer patients, or post-treatment follow-up according to current national guidelines.<sup>110</sup>

## **Discussion**

This review found consistent evidence for variations in survival and clinical management, limited evidence for variations in diagnostic outcomes and inconsistent evidence for variations in tumour characteristics by residential location of Australian female breast cancer patients.

While gaps in the literature limited our ability to draw clear links between identified variations and the drivers of these variations, there was good evidence that poorer breast cancer survival (at least up to five years after diagnosis) for non-metropolitan women reflects more advanced disease at diagnosis, greater comorbidities, treatment-related factors and area-level disadvantage.<sup>29 33 37 40-44</sup>

According to the recent systematic review by the International Agency for Research on Cancer (IARC)<sup>111</sup> there is sufficient evidence for the efficacy of mammographic screening in reducing breast-cancer mortality for women aged 50 to 69 years. In Australia, increasing participation for groups with low screening rates can be achieved through the existing and well established population-based national mammographic program (BreastScreen). Targeted strategies are required including thorough engagement and communication with primary care to improve screening participation rates.<sup>60</sup> It is possible that these survival patterns are impacted by the lead time caused by mammographic screening,<sup>112</sup> while we found only limited evidence that participation in the publicly funded BreastScreen services varies by geographical area, the lack of data on the number of privately screened women precludes an evaluation of actual population-based screening participation and its



impact on the observed survival patterns. Hence it remains a priority to explore means to combine data on public and private screening to gain more comprehensive information on total rates of breast cancer screening nationally.

The review found a consistent pattern of geographical variations in patterns of care and lower receipt of optimal clinical management for early breast cancer among non-metropolitan women in Australia. Reasons for these variations likely included limited access to oncological services and multidisciplinary care.<sup>113 114</sup> Regional Cancer Centres across Australia and integrated cancer networks were established to improve access to oncological care for regional patients.<sup>14 17</sup> However overcoming barriers to multidisciplinary care, considered best practice in breast cancer care,<sup>115-117</sup> in regional areas remains a challenge. Multidisciplinary cancer teams (MDT) are sparse outside metropolitan areas and vary widely in the disciplines represented within existing teams.<sup>114</sup>

The efficacy of MDT's in informed clinical decision making, coordinated care and evidence-based practice for breast cancer patients has been well documented.<sup>118-121</sup> Several of the included studies in this review identified limited access to MDT care for non-metropolitan women as a possible contributor to lower receipt of guideline concordant care,<sup>26 45 50 87 92 109</sup> It is possible that the major benefits of MDT lie, in part, with greater adherence to standard therapy,<sup>45 109 120</sup> which may indirectly impact clinical outcomes.

The evidence for the impact of MDT on breast cancer survival is more limited, possibly reflecting methodological limitations and heterogeneity in MDT definitions.<sup>120 122</sup> However, surgical specialization has been shown to be associated with improved survival,<sup>106</sup> and we found that non-metropolitan women had consistently poorer access to high-volume surgeons<sup>26 40 50 78</sup> which in Australia are predominantly based in major cities.<sup>123</sup>

Australian clinical practice guidelines for the management of early breast cancer recommend post-operative radiotherapy after breast conserving surgery to reduce the risk of local recurrence, adjuvant endocrine therapy and/or chemotherapy where appropriate based on hormone receptor status,<sup>124</sup> and sentinel node biopsy offered to women with unifocal clinically node negative tumours ( $\leq 30\text{mm}$ ).<sup>125</sup> However this review found limited but consistent evidence for geographical variations in receipt of care according to these guidelines. Specifically, non-metropolitan women were less likely to undergo adjuvant radiotherapy,<sup>40 50 54 73 84</sup> hormonal therapy,<sup>40</sup> or SNB.<sup>86-88</sup> Lower utilization of SNB in non-metropolitan areas may reflect inadequate access to necessary resources, less relevant training and experience in performing SNB among general surgeons outside major treatment centres<sup>87 88</sup> and lack of interdisciplinary collaboration required to perform SNB's.<sup>86-88</sup> Surgeon-level interventions may be required to help improve sentinel node biopsy rates and hence quality of care and reduced morbidity.

The finding that non-metropolitan women were less likely to receive adjuvant radiotherapy likely reflects variations in access to such facilities.<sup>73 84 101 102</sup> However it should be acknowledged that all included studies were published in the period 1<sup>st</sup> January 1990 to November 2017 and that some earlier studies may not reflect current practice and/or the impact of improved access to radiation services with the development of new radiotherapy infrastructure in regional Australia over the last five years.<sup>14 126</sup> Both service affordability and availability impact radiotherapy utilization<sup>127</sup> with the uptake of breast conserving surgery among regional women increasing after provision of a publicly funded local radiotherapy service.<sup>101</sup> Similar patterns were also reported for radiotherapy utilization among all regional cancer patients.<sup>128 129</sup> The waiting time from radiation oncologist assessment to receiving radiotherapy (for any cancer) has also improved over time.<sup>127</sup> although implementation of routine reporting of waiting times from diagnosis to commencing radiotherapy by geographical location would help identify when and where delays in referral and commencing treatment occur.

Given the potential survival benefits of adjuvant radiotherapy,<sup>130 131</sup> the lower utilization of radiotherapy among non-metropolitan women<sup>40 50 54 73</sup> and those with poorer access to radiotherapy facilities<sup>73 84 102</sup> is of concern.

Although some recent Queensland-based studies found limited evidence for a temporal reduction in geographical variations for breast cancer stage<sup>53</sup> and surgical patterns,<sup>78</sup> in practice these changes were subtle and although the non-metropolitan: metropolitan differential reduced, it was still evidence in the most recent time period. Moreover, despite improvements in survival over all areas in Queensland over time, geographical inequalities remained.<sup>34 36</sup> These studies highlight the importance of ongoing monitoring of measured outcomes along breast cancer continuum to assess whether there has been a definitive change in these variations and to identify key drivers of any changes.

While the review found consistent evidence for variations in breast cancer survival and clinical management, patterns were inconsistent for other outcomes, primarily due to heterogeneity of the included studies or in some cases a lack of studies. These findings emphasise the importance of the work of Cancer Australia (Australia's national cancer control agency) in establishing a national comprehensive system for recording breast cancer stage and clinical management at the population level thereby enabling accurate monitoring of the effectiveness of strategies and initiatives to improve breast cancer outcomes for non-metropolitan women in Australia.

On an international scale, inequities in access to specialised care<sup>103-105</sup> and geographical variations across the breast cancer continuum including screening,<sup>7</sup> stage at diagnosis<sup>9 132</sup> and patterns of care<sup>8 108 132-137</sup> are well documented. There is widespread consensus that these variations reflect a combination of socio-economic, demographic and environmental factors including geography, comorbidities, access, treatment and stage at diagnosis that defy easy solutions.<sup>7-9 104 105 132 136</sup> The persistence of such

inequities even for universal (publicly-funded) health-care systems<sup>7 104 132 134 137</sup> highlights the complexity of the underlying issues.

**Limitations**

A number of issues made direct comparisons and to some extent interpretation of findings across studies particularly challenging. The assessment of comparability was hampered by the wide variability in study quality, levels of evidence, methodology, data sources, time period and terminology. These issues also prevented meta-analyses being carried out. Many studies were predominantly conducted at the state-level, making the generalisation of findings to the national level difficult. The review also highlighted the need to improve and standardize definitions of geographical location to produce more uniform and reliable remoteness classifications. This would improve data comparability in terms of residential location and hence facilitate more definitive conclusions to be drawn on the strength of the available evidence. Similar concerns have been noted by international reviews on area-level variations in other cancer outcomes.<sup>8 138 139</sup>

Moreover, many studies had important limitations including selection bias and inadequate follow-up that impacted their quality. While using registry data allows generalizability of findings, such studies cannot comprehensively control for all potential confounders, especially those related to individual-level socio-economic status, clinical or treatment factors since Australian cancer registries do not routinely collect information on these measures.<sup>140</sup> Hence population-based studies can adjust for area-level socio-economic status but not between-persons differences. Only cross-sectional studies, although deemed inferior to population-based studies in terms of representativeness, can collect information on individual-level measures.

Considerable efforts were made to conduct a comprehensive search of existing literature on specified clinical questions by searching multiple databases with complex queries and evaluating reference lists of identified articles, published reviews and government reports to find additional articles. However, it is still possible that the search term criteria used could have unintentionally resulted in exclusion of relevant articles. Included articles were also limited to those indexed in the accessed databases.

**Conclusions**

By examining the current evidence relating to geographical variations in breast cancer outcomes across the continuum of care for Australian women, this review has important implications for clinical practice, service delivery and future research. It has highlighted the gap in knowledge of variations in the treatment of advanced breast cancers, patient decision making and post-treatment follow-up.

While addressing the geographical variations in breast cancer survival and clinical management will require a multifaceted approach, initial efforts could include improving access to and participation in breast screening programs, raising awareness of the benefits of early detection and enabling all women diagnosed with breast cancer to be assessed by a multidisciplinary team that considers all relevant treatment options and have access to best practice treatment. To achieve equitable access for all women, it is crucial to promote coordinated care among non-metropolitan women and initiatives to facilitate the educational diffusion of health care changes among clinicians and patients through emerging technologies<sup>141</sup> to overcome barriers of distance. Recognising the heterogeneity of existing studies in terms of geographical coverage and definitions, the establishment of a national comprehensive system for recording breast cancer stage and clinical management would enable accurate monitoring of the success of these initiatives.

Finally, encouraging evidence-based research aimed at better understanding the reasons for geographical variations in breast cancer management and outcomes at each stage of the continuum of care needs to be a priority to inform the development of targeted initiatives to improve survival and quality of life for rural and remote women with breast cancer in Australia.

**Funding**

This project was funded by Cancer Australia. Dr Philippa Youl and Professor Gail Garvey are funded by a National Health and Medical Research Council Early Career Fellowship (#1054038 and #1105399 respectively).

**Conflict of Interest**

The authors report no conflict of interest.

**Authors Contributions**

All authors, PY, PB, PD, DY, JA, GG, IW, JC and HZ contributed to the design of the study. PY and PB coordinated the study; PD conducted the literature searches and drafted the manuscript; PD, PY, DY and PB all acted as reviewers and participated in data collection; PY, PB, DY, JA and GG contributed to the initial draft of the manuscript and all authors, PY, PB, PD, DY, JA, GG, IW, JC and HZ refined and approved the final version of the paper.

**Acknowledgements**

The project was commissioned and funded by Cancer Australia. The authors would like to acknowledge the advice of the Project Steering Committee.

**Data sharing statement**

No additional data are available

**Patient consent**

Not relevant

## Figure legends

Figure 1: Process of inclusion and exclusion of studies for the systematic review

## Supplementary files

### **Supplementary file 1 Database-specific search queries by individual clinical questions.**

Additional file 1 lists search queries for the searched databases by each of the individual clinical questions in numerical order.

*File name: Supplementary file 1.pdf*

**Supplementary file 2 Quality appraisal tools for included quantitative studies.** Additional file 2 shows the scoring system used for quality appraisal of the included quantitative studies.

*File name: Supplementary file 2.pdf*

**Supplementary file 3 Excluded studies with reasons for exclusion.** Additional file 3 lists the excluded studies with reasons for exclusion in alphabetical order by author.

*File name: Supplementary file 3.pdf*

### **Supplementary file 4 Detailed characteristics of the included studies by three key themes.**

Additional file 4 presents detailed characteristics on included studies by key themes of survival outcome, patient and tumour characteristics and diagnostic and treatment outcomes

*File name: Supplementary file 4.pdf*



Table 1: Clinical questions guiding the systematic review

<b><u>Survival Outcomes</u></b>
1. In women diagnosed with breast cancer, do non-metropolitan women have poorer breast cancer survival compared to metropolitan women in Australia?
<b><u>Patient and Tumour Characteristics</u></b>
2. In women diagnosed with breast cancer, do non-metropolitan women have different socio-demographic characteristics compared to metropolitan women in Australia?
3. In women diagnosed with breast cancer, do non-metropolitan women have more advanced tumour characteristics compared to metropolitan women in Australia?
<b><u>Diagnostic and Treatment Outcomes</u></b>
4. In women diagnosed with breast cancer, are non-metropolitan women in the breast screening target group less likely to access breast screening services compared to metropolitan women in Australia?
5. In women diagnosed with breast cancer, are non-metropolitan women in the breast screening target group less likely to adhere to recommended breast screening intervals (2 yearly) compared to metropolitan women in Australia?
6. In women diagnosed with breast cancer, are there differences in the clinical management between non-metropolitan and metropolitan women in Australia?
7. In women diagnosed with breast cancer, are non-metropolitan women less likely to receive the recommended clinical management compared to metropolitan women in Australia?
8. In women diagnosed with breast cancer, are non-metropolitan women more likely to experience delays in referral to breast cancer specialist clinicians compared to metropolitan women in Australia?
9. In women diagnosed with breast cancer, do non-metropolitan women experience fewer treatment options compared to metropolitan women in Australia?
10. In women diagnosed with breast cancer, are non-metropolitan women less likely to complete prescribed treatment compared to metropolitan women in Australia?
11. In women diagnosed with breast cancer, are non-metropolitan women less likely to participate in recommended follow-up compared to metropolitan women in Australia?

**Table 2: Summary scores, overall grades and Levels of evidence for included studies**

Study	Metropolitan/non-metropolitan definition	Score <sup>2</sup>	Quality <sup>3</sup>	Level <sup>4</sup>
Adelson <i>et al</i> 1997 <sup>74</sup>	Based on health services	15	High	III-3
Ahern <i>et al</i> 2015 <sup>85</sup>	ARIA+ Remoteness Index	7	Low	IV
Ahern <i>et al</i> 2016 <sup>95</sup>	ARIA+ Remoteness Index	7	Low	IV
AIHW 2013 <sup>28</sup>	ARIA+ Remoteness Index	14.5	High	II
Azzopardi <i>et al</i> 2014 <sup>73</sup>	ASGC	9	Moderate	II
Baade <i>et al</i> 2011 <sup>52</sup>	ARIA+ Remoteness Index	16.5	High	II
Baade <i>et al</i> 2016 <sup>78</sup>	Distance to radiation treatment facilities	16	High	II
Barratt <i>et al</i> 1997 <sup>63</sup>	RRMA Classification	9.5	Moderate	II
Bell <i>et al</i> 2012 <sup>89</sup>	Postcodes <sup>1</sup>	15	High	II
Bonnet <i>et al</i> 1990 <sup>30</sup>	Postcodes <sup>1</sup>	14.5	High	II
Budden <i>et al</i> 2014 <sup>98</sup>	N/A: regional women only	10	Moderate	IV
Campbell <i>et al</i> 2006 <sup>96</sup>	Based on residential area	9.5	Moderate	III-3
Chen <i>et al</i> 2015 <sup>31</sup>	ARIA+ Remoteness Index	15.5	High	II
Clayforth <i>et al</i> 2007 <sup>32</sup>	Postcodes <sup>1</sup>	15	High	II
Cockburn <i>et al</i> 1997 <sup>68</sup>	N/A: rural and remote women only	10	Moderate	III-3
Chong <i>et al</i> 2015 <sup>86</sup>	ASGC	13	Moderate	III-3
Collins <i>et al</i> 2017 <sup>102</sup>	N/A: regional women only	14	High	II
Craft <i>et al</i> 1997 <sup>79</sup>	RRMA Classification	12	Moderate	III-3
Cramb <i>et al</i> 2012 <sup>33</sup>	Distance to radiation treatment facilities	15.5	High	II
Cramb <i>et al</i> 2016a <sup>35</sup>	ASGC	14	High	II
Cramb <i>et al</i> 2016b <sup>34</sup>	ASGC	15	High	II
Cramb <i>et al</i> 2017 <sup>36</sup>	ASGS	15	High	II
Dasgupta <i>et al</i> 2012 <sup>37</sup>	ARIA	16.5	High	II
Dasgupta <i>et al</i> 2017a <sup>53</sup>	Distance to radiation treatment facilities	16	High	II
Dasgupta <i>et al</i> 2017b <sup>87</sup>	Distance to radiation treatment facilities	16	High	II
Dasgupta <i>et al</i> 2017c <sup>90</sup>	Distance to radiation treatment facilities	16	High	II
Depczynski, <i>et al</i> 2017 <sup>55</sup>	ARIA+ Remoteness Index	13	Moderate	III-3
Eley <i>et al</i> 2008 <sup>97</sup>	N/A: rural and remote women only	7.5	Low	IV
Flitcroft <i>et al</i> 2016 <sup>91</sup>	ARIA+ Remoteness Index	10	Moderate	III-3
Fox <i>et al</i> 2013 <sup>56</sup>	RRMA Classification	10.5	Moderate	III-3
Hall & Holman 2003 <sup>93</sup>	ARIA	14.5	High	II
Hall <i>et al</i> 2004a <sup>38</sup>	ARIA	15	High	II
Hall <i>et al</i> 2004b <sup>81</sup>	ARIA	14.5	High	II
Hill <i>et al</i> 1994 <sup>80</sup>	Postcodes <sup>1</sup>	12.5	Moderate	II
Hsieh <i>et al</i> 2014 <sup>49</sup>	ARIA+ Remoteness Index	14	High	II
Hsieh <i>et al</i> 2015 <sup>84</sup>	Distance to radiation treatment facilities	14	High	II
Hsieh <i>et al</i> 2016a <sup>39</sup>	ASGC	14	High	II
Hsieh <i>et al</i> 2016b <sup>48</sup>	ARIA+ Remoteness Index	15	High	II
Hughes <i>et al</i> 2014 <sup>69</sup>	Postcodes <sup>1</sup>	10.5	Moderate	III-3
Kok <i>et al</i> 2006 <sup>54</sup>	RRMA Classification	14.5	High	III-3
Koshy <i>et al</i> 2005 <sup>82</sup>	Postcodes <sup>1</sup>	9.5	Moderate	III-3
Kricker <i>et al</i> 2001 <sup>83</sup>	Unclear	16	High	II
Lai <i>et al</i> 2007 <sup>94</sup>	RRMA Classification	15	High	II
Lam <i>et al</i> 2015 <sup>101</sup>	N/A: regional women only	10	Moderate	IV

Study	Metropolitan/non-metropolitan definition	Score <sup>2</sup>	Quality <sup>3</sup>	Level <sup>4</sup>
Leung <i>et al</i> 2014 <sup>61</sup>	ARIA+ Remoteness Index	12.5	Moderate	III-3
Leung <i>et al</i> 2015 <sup>62</sup>	ARIA+ Remoteness Index	12	Moderate	III-3
Leung <i>et al</i> 2016 <sup>58</sup>	ARIA+ Remoteness Index	13	Moderate	III-3
Lord <i>et al</i> 2012 <sup>57</sup>	ARIA	14	High	II
Luke <i>et al</i> 2004 <sup>59</sup>	Postcodes <sup>1</sup>	14	High	II
Martin <i>et al</i> 2006 <sup>75</sup>	Based on residential area	14.5	High	II
Mastaglia & Kristjanson 2001 <sup>76</sup>	Unclear	6.5	Low	IV
Mitchell <i>et al</i> 2006 <sup>40</sup>	Postcodes <sup>1</sup>	16	High	II
Morris <i>et al</i> 2012 <sup>88</sup>	ASGC	10.5	Moderate	III-3
O’Byrne <i>et al</i> 2000 <sup>70</sup>	RRMA Classification	15.5	High	III-3
Ristevski <i>et al</i> 2012 <sup>99</sup>	N/A: regional women only	9	Moderate	IV
Roder <i>et al</i> 2012a <sup>29</sup>	ASGC	14.5	High	III-3
Roder <i>et al</i> 2012b <sup>109</sup>	ASGC	14	High	III-3
Roder <i>et al</i> 2013a <sup>50</sup>	ASGC	14	High	III-3
Roder <i>et al</i> 2013b <sup>26</sup>	ASGC	14.5	High	III-3
Roder <i>et al</i> 2013c <sup>92</sup>	ASGC	14.5	High	III-3
Roder <i>et al</i> 2014 <sup>51</sup>	ASGC	15	High	III-3
Schofield <i>et al</i> 1994 <sup>66</sup>	Distance to screening services	10.5	Moderate	II
Siapush & Singh 2002 <sup>67</sup>	Based on residential area	12.5	Moderate	II
Spilsbury <i>et al</i> 2005 <sup>41</sup>	Postcodes <sup>1</sup>	16	High	II
Sullivan <i>et al</i> 2003 <sup>64</sup>	Postcodes <sup>1</sup>	11	Moderate	III-3
Supramaniam <i>et al</i> 2014 <sup>42</sup>	ARIA+ Remoteness Index	17	High	II
Taylor 1997 <sup>47</sup>	capital city, other metropolitan, rural	14.5	High	II
Tervonen <i>et al</i> 2017 <sup>43</sup>	ARIA+ Remoteness Index	14	High	II
Thompson <i>et al</i> 2008 <sup>77</sup>	ARIA+ Remoteness Index	14.5	High	II
Tracey <i>et al</i> 2008 <sup>44</sup>	ARIA	15	High	II
Tulloh & Goldsworthy 1997 <sup>100</sup>	N/A: rural and remote women only	7	Low	III-3
Weber <i>et al</i> 2014 <sup>65</sup>	ARIA+ Remoteness Index	10.5	Moderate	III-3
Wilkinson & Cameron 2004 <sup>46</sup>	Postcodes <sup>1</sup>	9.5	Moderate	II
Yu <i>et al</i> 2015 <sup>45</sup>	ARIA+ Remoteness Index	12	Moderate	II

ARIA Accessibility/Remoteness Index of Australia; ASGC Australian Standard Geographical Classification; ASGS Australian Standard Geographical Standard; N/A Not applicable; RRMA Rural, Remote and Metropolitan Areas

1. Postcodes within state capital were considered metropolitan, remaining were non-metropolitan
2. Average score over scores from two independent reviewers. Please refer to text for further details.
3. Quality categories: High (score 14-18), Moderate (score 9-13.5) or Low (score <9); please refer to text for further details.
4. Australian National Health and Medical Research Council (NHMRC)<sup>24</sup> levels of evidence in decreasing order of strength are Level I, Level II, Level III-1, Level III-2, Level III-3 and Level IV.

**Table 3** Summary of included studies on differentials in breast cancer survival outcomes by residential location

Author, year	Location <sup>1</sup>	Period (follow-up)	Sample size	Poorer survival	
				Unadjusted	Adjusted <sup>2</sup>
AIHW 2013 <sup>28</sup>	National	1982-2007 (end 2010)	NS	Non-metropolitan	NR
Wilkinson & Cameron 2004 <sup>46</sup>	SA	1977-1993 (to 2000)	NS	Non-metropolitan	NR
Cramb <i>et al</i> 2012 <sup>33</sup>	Qld	1996-2007	25,202	Non-metropolitan	No difference (s, d)
Dasgupta <i>et al</i> 2012 <sup>37</sup>	Qld	1997-2006 (end 2007)	18,568	Non-metropolitan	No difference (s, d)
Hsieh <i>et al</i> 2016b <sup>48</sup>	Qld	1997-2007 (end 2008)	9,741	Non-metropolitan	No difference (s, d)
Tervonen <i>et al</i> 2017 <sup>43</sup>	NSW	1980-2008 (end 2009)	88,768	Non-metropolitan	No difference (s, d)
Tracey <i>et al</i> 2008 <sup>44</sup>	NSW	1980-2003 (end 2004)	59,731	Non-metropolitan	No difference (s, d)
Mitchell <i>et al</i> 2006 <sup>40</sup>	WA	1999 (end 2004)	899	Non-metropolitan	No difference (s, t)
Supramaniam <i>et al</i> 2014 <sup>42</sup>	NSW	2001-2007 (end 2008)	27,850	Non-metropolitan	No difference (s, d, t, c)
Roder <i>et al</i> 2012a <sup>29</sup>	National	1991-2006	62,082	Non-metropolitan	No difference (d)
Hall <i>et al</i> 2004a <sup>38</sup>	WA	1991-2001	7,117	Non-metropolitan	No difference (d, t, c)
Spilsbury <i>et al</i> 2005 <sup>41</sup>	WA	1982-2000	11,445	Non-metropolitan	No difference (d, t, c)
Taylor 1997 <sup>47</sup>	NSW	1980-1991 (end 1992)	25,793	No difference	No difference (s)
Bonnet <i>et al</i> 1990 <sup>30</sup>	SA	1980-1986 (end 1988)	2,565	Non-metropolitan	Non-metropolitan (s)
Chen <i>et al</i> 2015 <sup>31</sup>	NSW	2000-2008	36,867	Non-metropolitan	Non-metropolitan (s)
Cramb <i>et al</i> 2016a <sup>35</sup>	Qld	1997-2011	NS	Non-metropolitan	Non-metropolitan (s)
Cramb <i>et al</i> 2016b <sup>34</sup>	Qld	1997-2011	34,231	Non-metropolitan	Non-metropolitan (s)
Hsieh <i>et al</i> 2014 <sup>49</sup>	Qld	1997-2007 (end 2008)	23,766	Non-metropolitan	Non-metropolitan (s, d)
Hsieh <i>et al</i> 2016a <sup>39</sup>	Qld	1997-2007 (end 2008)	23,766	Non-metropolitan	Non-metropolitan (s)
Yu <i>et al</i> 2015 <sup>45</sup>	NSW	1987-2007 (end 2007)	63,757	Non-metropolitan	Non-metropolitan (s, d)
Clayforth <i>et al</i> 2007 <sup>32</sup>	WA	1989, 1994, 1999 (end 2005)	1,729	Non-metropolitan	Non-metropolitan (s, t)
Cramb <i>et al</i> 2017 <sup>36</sup>	Qld	1997-2004 (end 2005); 2005-2012 (end 2013)	38,204	Non-metropolitan	Non-metropolitan

NR not relevant, NS not stated

1. National: all states/territories; NSW: New South Wales; Qld: Queensland; SA: South Australia and WA Western Australia

2. All adjusted for age except Bonnet *et al* 1990<sup>30</sup>

(s) Also adjusted for some measure of spread of diagnosis, such as stage at diagnosis or tumour diameter

(t) Also adjusted for treatment-related factors

(d) Also adjusted for area-disadvantage

(c) Also adjusted for comorbidities

22

**Table 4** Summary of included studies on differentials in patient and tumour characteristics by residential location

Author, year	Location <sup>1</sup>	Period	Sample size	Finding <sup>2</sup>
<i>Patient characteristics (higher area-level socio-economic disadvantage)</i>				
Roder <i>et al</i> 2013a <sup>50</sup>	National	1998-2010	30,299	Non-metropolitan
Roder <i>et al</i> 2014 <sup>51</sup>	National	1998-2010	30,299	Non-metropolitan
<i>Tumour characteristics (higher spread of disease)<sup>3</sup></i>				
Bonnet <i>et al</i> 1990 <sup>30</sup>	SA	1980-1986	1,171	No difference
Depczynski, <i>et al</i> 2017 <sup>55</sup>	NSW	2006-2009	726	No difference
Fox <i>et al</i> 2013 <sup>56</sup>	NSW	2008-2011	400	No difference
Leung <i>et al</i> 2016 <sup>58</sup>	NSW, Qld, Vic	1997-2011	195	No difference
Lord <i>et al</i> 2012 <sup>57</sup>	NSW	2001-2002	6,664	No difference
Luke <i>et al</i> 2004 <sup>59</sup>	SA	1997-2002	4,912	No difference
Mitchell <i>et al</i> 2006 <sup>40</sup>	WA	1999	899	No difference
Wilkinson & Cameron 2004 <sup>46</sup>	SA	1980-1998	NS	No difference
Baade <i>et al</i> 2011 <sup>52</sup>	Qld	1997-2006	18,568	Non-metropolitan
Dasgupta <i>et al</i> 2017a <sup>53</sup>	Qld	1997-2014	38,706	Non-metropolitan
Kok <i>et al</i> 2006 <sup>54</sup>	Vic	1993-2000	5,294	Non-metropolitan
Roder <i>et al</i> 2013b <sup>26</sup>	National	1998-2010	30,299	Non-metropolitan
Tracey <i>et al</i> 2008 <sup>44</sup>	NSW	1980-2003	59,731	Metropolitan

NS not stated

1. National: all states/territories; NSW: New South Wales; Qld: Queensland; SA: South Australia; Vic: Victoria and WA Western Australia
2. Some measure of spread of disease such as stage at diagnosis or tumour size.

**Table 5** Summary of included studies on differentials in diagnostic outcomes by residential location

Author, year	Location <sup>1</sup>	Period	Sample size <sup>2</sup>	Finding
<i>Higher screening rate<sup>3</sup></i>				
Barratt <i>et al</i> 1997 <sup>63</sup>	National	1996	1,035	No difference
Leung <i>et al</i> 2014 <sup>61</sup>	National	2001-2010	11,200	No difference.
Leung <i>et al</i> 2015 <sup>62</sup>	National	2010	10,011	No difference
Sullivan <i>et al</i> 2003 <sup>64</sup>	WA	1982-2000	380	Non-metropolitan
Weber <i>et al</i> 2014 <sup>65</sup>	NSW	2006-2010	101,063	Non-metropolitan
Schofield <i>et al</i> 1994 <sup>66</sup>	Vic	1988-1990	668	Metropolitan
Siapush & Singh 2002 <sup>67</sup>	National	1995	10,179	Metropolitan
Cockburn <i>et al</i> 1997 <sup>68</sup>	Vic	1995	180 non-metropolitan	No screening history and knowing service locations screening predictors
<i>Higher rescreening rate<sup>4</sup></i>				
Hughes <i>et al</i> 2014 <sup>69</sup>	WA	1999-2008	NS	No difference
Leung <i>et al</i> 2014 <sup>61</sup>	National	2001-2010	11,200	Non-metropolitan
Leung <i>et al</i> 2015 <sup>62</sup>	National	2010	10,011	Non-metropolitan
O'Byrne <i>et al</i> 2000 <sup>70</sup>	Vic	1995-1996	121,889	Non-metropolitan
Siapush & Singh 2002 <sup>67</sup>	National	1995	10,179	Metropolitan

1. National: all states/territories; NSW: New South Wales; Vic: Victoria and WA Western Australia
2. Only aged 50-69 years who were eligible at time of this review and all included studies for publicly funded BreastScreen program in Australia
3. Having had at least one screening mammogram
4. Having another screening mammogram within two years of the initial screen



**Table 6** Summary of included studies on differentials in treatment outcomes by residential location

Author, year	Location <sup>1</sup>	Period	Sample size	Finding
<b>Higher mastectomy</b>				
Koshy <i>et al</i> 2005 <sup>82</sup>	NSW, ACT	1997-2002	1,069	No difference
Kricker <i>et al</i> 2001 <sup>83</sup>	NSW	1992, 1995	2,020 or 2,883	No difference
Adelson <i>et al</i> 1997 <sup>74</sup>	NSW	1991-1992	4,038	Non-metropolitan
Azzopardi <i>et al</i> 2014 <sup>73</sup>	National	1998-2012	21,643	Non-metropolitan
Martin <i>et al</i> 2006 <sup>75</sup>	WA	1990-1999	2,713	Non-metropolitan
Mastaglia & Kristjanson 2001 <sup>76</sup>	WA	1996-1997	160	Non-metropolitan
Roder <i>et al</i> 2013b <sup>26</sup>	National	1998-2010	30,299	Non-metropolitan
Thompson <i>et al</i> 2008 <sup>77</sup>	Qld	2004-2005	1,274	Non-metropolitan
<b>Higher breast conserving surgery</b>				
Hall <i>et al</i> 2004b <sup>81</sup>	WA	1991-2000	7,304	No difference
Adelson <i>et al</i> 1997 <sup>74</sup>	NSW	1991-1992	4,038	Metropolitan
Azzopardi <i>et al</i> 2014 <sup>73</sup>	National	1998-2012	21,643	Metropolitan
Baade <i>et al</i> 2016 <sup>78</sup>	Qld	1997-2011	11,631	Metropolitan
Craft <i>et al</i> 1997 <sup>79</sup>	National	1993	4,683	Metropolitan
Hill <i>et al</i> 1994 <sup>80</sup>	Vic	1990	856	Metropolitan
Kok <i>et al</i> 2006 <sup>54</sup>	Vic	1993-2000	5,294	Metropolitan
Mitchell <i>et al</i> 2006 <sup>40</sup>	WA	1999	899	Metropolitan
Roder <i>et al</i> 2013a <sup>50</sup>	National	1998-2010	30,299	Metropolitan
<b>Lower radiotherapy</b>				
Azzopardi <i>et al</i> 2014 <sup>73</sup>	National	1998-2012	21,643	Non-metropolitan
Hsieh <i>et al</i> 2015 <sup>84</sup>	Qld	1997-2008	6,357	Non-metropolitan
Kok <i>et al</i> 2006 <sup>54</sup>	Vic	1993-2000	5,294	Non-metropolitan
Mitchell <i>et al</i> 2006 <sup>40</sup>	WA	1999	899	Non-metropolitan
Roder <i>et al</i> 2013a <sup>50</sup>	National	1998-2010	30,299	Non-metropolitan
<b>Lower hormonal therapy</b>				
Ahern <i>et al</i> 2015 <sup>85</sup>	National	2013	325	No difference
Hsieh <i>et al</i> 2015 <sup>84</sup>	Qld	1997-2008	6,357	No difference
Mitchell <i>et al</i> 2006 <sup>40</sup>	WA	1999	899	Non-metropolitan
<b>Lower chemotherapy</b>				
Hsieh <i>et al</i> 2015 <sup>84</sup>	Qld	1997-2008	6,357	No difference
Hill <i>et al</i> 1994 <sup>80</sup>	Vic	1990	856	No difference
Mitchell <i>et al</i> 2006 <sup>40</sup>	WA	1999	899	No difference
Roder <i>et al</i> 2013a <sup>50</sup>	National	1998-2010	30,299	Metropolitan
<b>Lower sentinel node biopsy</b>				
Chong <i>et al</i> 2015 <sup>86</sup>	National	2008-2010	18,737	Non-metropolitan
Dasgupta <i>et al</i> 2017b <sup>87</sup>	Qld	July 2008-December 2012	5,577	Non-metropolitan
Morris <i>et al</i> 2012 <sup>88</sup>	National	2008 (last 6 months)	1,267 to	Non-metropolitan
<b>Lower axillary surgery</b>				
Craft <i>et al</i> 1997 <sup>79</sup>	National	1993	4,683	No difference
Kricker <i>et al</i> 2001 <sup>83</sup>	NSW	1992, 1995	2,020 or 2,883	No difference
Thompson <i>et al</i> 2008 <sup>77</sup>	Qld	2004-2005	1,274	No difference
<b>Lower breast reconstruction</b>				
Hall & Holman 2003 <sup>93</sup>	WA	1991-2000	7,303	No difference
Bell <i>et al</i> 2012 <sup>89</sup>	Vic	2004-2006	366	Non-metropolitan
Dasgupta <i>et al</i> 2017c <sup>90</sup>	Qld	1997-2012	4,104	Non-metropolitan

Author, year	Location <sup>1</sup>	Period	Sample size	Finding
Flitcroft <i>et al</i> 2016 <sup>91</sup>	National	2013	3,786	Non-metropolitan
Roder <i>et al</i> 2013c <sup>92</sup>	National	1998-2010	12,207	Non-metropolitan
<b>Higher unplanned admissions</b>				
Lai <i>et al</i> 2007 <sup>94</sup>	WA	1995-1999	2,703	Non-metropolitan
<b>Access breast care nurses</b>				
Ahern <i>et al</i> 2016 <sup>95</sup>	National	2013	902	No difference
Campbell <i>et al</i> 2006 <sup>96</sup>	National	1997	544	No difference
<b>Longer treatment delays</b>				
Fox <i>et al</i> 2013 <sup>86</sup>	NSW	2008-2011	400	Non-metropolitan
<b>Poorer quality of care</b>				
Hill <i>et al</i> 1994 <sup>80</sup>	Vic	1990	856	Non-metropolitan
Fox <i>et al</i> 2013 <sup>86</sup>	NSW	2008-2011	400	Non-metropolitan
Baade <i>et al</i> 2016 <sup>78</sup>	Qld	1997-2011	11,631	Non-metropolitan
Mitchell <i>et al</i> 2006 <sup>40</sup>	WA	1999	899	Non-metropolitan
Roder <i>et al</i> 2013a <sup>50</sup>	National	1998-2010	30,299	Non-metropolitan
Roder <i>et al</i> 2013b <sup>26</sup>	National	1998-2010	30,299	Non-metropolitan
<b>Treatment completion</b>				
Fox <i>et al</i> 2013 <sup>86</sup>	NSW	2008-2011	400	Non-metropolitan more likely to complete chemotherapy
Roder <i>et al</i> 2012b <sup>109</sup>	National	1998-2005	36,775	Non-metropolitan less likely to follow clinician recommended treatments
<b>Non-metropolitan</b>				
Budden <i>et al</i> 2014 <sup>98</sup>	Qld	NS	104	High level satisfaction with treatment decisions
Eley <i>et al</i> 2008 <sup>97</sup>	Qld	2005-2006	51	Breast cancer nurses important source of care
Ristevski <i>et al</i> 2012 <sup>99</sup>	Vic	NS	70	High level satisfaction with treatment decisions
Tulloh & Goldsworthy 1997 <sup>100</sup>	Vic	1992-1995	28	Rural setting did not influence quality of care
Lam <i>et al</i> 2015 <sup>101</sup>	NSW	2010-2014	574	A locally available publicly funded radiotherapy service increased breast conserving surgery uptake.
Collins <i>et al</i> 2017 <sup>102</sup>	Vic	2009-2014	1,213	Access to radiotherapy impacts surgical management

1. National: all states/territories; NSW: New South Wales; Vic: Victoria and WA Western Australia

References

1. Ferlay J, Soerjomataram I, Dikshit R, et al. Cancer incidence and mortality worldwide: Sources, methods and major patterns in GLOBOCAN 2012. *Int J Cancer* 2015;136(5):E359-E86.

2. AIHW. Australian Cancer Incidence and Mortality (ACIM) books Canberra: Australian Institute of Health and Welfare; 2014 [Available from: <http://www.aihw.gov.au/acim-books>] accessed 23 January 2015.

3. Youlden DR, Cramb SM, Dunn NA, et al. The descriptive epidemiology of female breast cancer: an international comparison of screening, incidence, survival and mortality. *Cancer Epidemiol* 2012;36(3):237-48.

4. McKenzie F, Ives A, Jeffreys M. Socio-economic inequalities in survival from screen-detected breast cancer in South West England: population-based cohort study. *Eur J Public Health* 2012;22(3):418-22.

5. Panagopoulou P, Gogas H, Dessypris N, et al. Survival from breast cancer in relation to access to tertiary healthcare, body mass index, tumor characteristics and treatment: a Hellenic Cooperative Oncology Group (HeCOG) study. *Eur J Epidemiol* 2012;27(11):857-66.

6. Sprague BL, Trentham-Dietz A, Gangnon RE, et al. Socioeconomic status and survival after an invasive breast cancer diagnosis. *Cancer* 2011;117(7):1542-51.

7. Leung J, McKenzie S, Martin J, et al. Effect of rurality on screening for breast cancer: a systematic review and meta-analysis comparing mammography. *Rural Remote Health* 2014;14(2):2730.

8. Meilleur A, Subramanian SV, Plascak JJ, et al. Rural Residence and Cancer Outcomes in the United States: Issues and Challenges. *Cancer Epidemiol Biomarkers Prev* 2013;22(10):1657-67.

9. Nguyen-Pham S, Leung J, McLaughlin D. Disparities in breast cancer stage at diagnosis in urban and rural adult women: a systematic review and meta-analysis. *Ann Epidemiol* 2014;24(3):228-35.

10. Coleman MP, Forman D, Bryant H, et al. Cancer survival in Australia, Canada, Denmark, Norway, Sweden, and the UK, 1995-2007 (the International Cancer Benchmarking Partnership): an analysis of population-based cancer registry data. *Lancet* 2011;377(9760):127-38.

11. AIHW. Breast cancer in Australia: an overview Cancer series no. 71. Cat. no. CAN 67: Australian Institute of Health & Welfare, Canberra; 2012 [Available from: <https://www.aihw.gov.au/reports/cancer/breast-cancer-in-australia-an-overview/contents/table-of-contents>] accessed 23 January 2015.

12. AIHW. Cancer survival and prevalence in Australia: period estimates from 1982 to 2010. Cat. no. CAN 65: Australian Institute of Health & Welfare, Canberra; 2012 [Available from: <https://www.aihw.gov.au/reports/cancer/cancer-survival-and-prevalence-in-australia-perio/contents/table-of-contents>] accessed 23 January 2015.

13. Underhill C, Bartel R, Goldstein D, et al. Mapping oncology services in regional and rural Australia. *Aust J Rural Health* 2009;17(6):321-29.

14. Smith T. A long way from home: Access to cancer care for rural Australians. *Radiography* 2012;18(1):38-42.

15. ABS. Regional Population Growth, Australia, 2012-13 Canberra: Australian Bureau of Statistics (ABS) 2013 [Available from: <http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/3218.0Main+Features12012-13?OpenDocument>] accessed 24 February 2015.

16. AIHW. Rural, regional and remote health: a study on mortality (2nd edition) Rural Health Series no.8. Cat. no. PHE 95: Australian Institute of Health & Welfare, Canberra; 2007 [Available from: <https://www.aihw.gov.au/reports/rural-remote-australians/rural-regional-remote-mortality-study-2nd-edition/contents/table-of-contents>] accessed 24 February 2015.

17. Murphy C, Sabesan S, Steer C, et al. Oncology service initiatives and research in regional Australia. *Aust J Rural Health* 2015;23(1):40-48.
18. Youl PH, Dasgupta P, Youlden D, et al. A systematic review of inequalities in psychosocial outcomes for women with breast cancer according to residential location and Indigenous status in Australia. *Psychooncology* 2016;25(10):1157-67.
19. Dasgupta P, Baade PD, Youlden DR, et al. Variations in outcomes for Indigenous women with breast cancer in Australia: A systematic review. *Eur J Cancer Care (Engl)* 2017;26(6).
20. Liberati A, Altman DG, Tetzlaff J, et al. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: explanation and elaboration. *BMJ* 2009;339:b2700.
21. University of the Sunshine Coast. Answering a Good Question (PICO) 2015 [Available from: <http://www.usc.edu/hsc/ebnet/ebframe/PICO.htm#C>] accessed 8 May 2015.
22. Wells G, Shea B, O'Connell D, et al. The Newcastle-Ottawa Scale (NOS) for assessing the quality of non-randomised studies in meta-analyses 2013 [Available from: [http://www.ohri.ca/programs/clinical\\_epidemiology/oxford.asp](http://www.ohri.ca/programs/clinical_epidemiology/oxford.asp)] accessed 20 February 2015.
23. Higgins JPT, Green S, editors. *Cochrane handbook for systematic reviews of interventions version 5.1.0, [updated March 2011]* Available from [www.cochrane-handbook.org](http://www.cochrane-handbook.org) : The Cochrane Collaboration 2011.
24. NHMRC. NHMRC levels of evidence and grades for recommendations for guideline developers: National Health and Medical Research Council, Canberra; 2009 [Available from: [https://www.nhmrc.gov.au/\\_files\\_nhmrc/file/guidelines/developers/nhmrc\\_levels\\_grades\\_evidence\\_120423.pdf](https://www.nhmrc.gov.au/_files_nhmrc/file/guidelines/developers/nhmrc_levels_grades_evidence_120423.pdf)] accessed 24 February 2015.
25. University of York. Systematic Reviews, CRD's guidance for undertaking reviews in health care. University of York: Centre for Reviews and Dissemination; 2008 [Available from: <http://www.york.ac.uk/crd/guidance/>] accessed 24 March 2015.
26. Roder D, Zorbas H, Kollias J, et al. Factors predictive of treatment by Australian breast surgeons of invasive female breast cancer by mastectomy rather than breast conserving surgery. *Asian Pac J Cancer Prev* 2013;14(1):539-45.
27. AIHW. Rural, regional and remote health: A guide to remoteness classifications. Cat. No. PHE 53. Canberra: Australian Institute of Health and Welfare, 2004.
28. AIHW. Cancer survival and prevalence in Australia: Period estimates from 1982 to 2010. *Asia Pac J Clin Oncol* 2013;9(1):29-39.
29. Roder D, Webster F, Zorbas H, et al. Breast screening and breast cancer survival in Aboriginal and Torres Strait Islander women of Australia. *Asian Pac J Cancer Prev* 2012;13(1):147-55.
30. Bonett A, Dorsch M, Roder D, et al. Infiltrating ductal carcinoma of the breast in South Australia. Implications of trends in tumour diameter, nodal status and case-survival rates for cancer control. *Med J Aust* 1990;152(1):19-23.
31. Chen TY, Morrell S, Thomson W, et al. Survival from breast, colon, lung, ovarian and rectal cancer by geographical remoteness in New South Wales, Australia, 2000-2008. *Aust J Rural Health* 2015;23(1):49-56.
32. Clayforth C, Fritschi L, McEvoy SP, et al. Five-year survival from breast cancer in Western Australia over a decade. *Breast* 2007;16(4):375-81.
33. Cramb SM, Mengersen KL, Turrell G, et al. Spatial inequalities in colorectal and breast cancer survival: premature deaths and associated factors. *Health Place* 2012;18(6):1412-21.

34. Cramb SM, Mengersen KL, Baade PD. Spatio-temporal relative survival of breast and colorectal cancer in Queensland, Australia 2001-2011. *Spat Spatiotemporal Epidemiol* 2016;19:103-14.

35. Cramb SM, Mengersen KL, Lambert PC, et al. A flexible parametric approach to examining spatial variation in relative survival. *Stat Med* 2016;35(29):5448-63.

36. Cramb SM, Moraga P, Mengersen KL, et al. Spatial variation in cancer incidence and survival over time across Queensland, Australia. *Spat Spatiotemporal Epidemiol* 2017;23:59-67.

37. Dasgupta P, Baade PD, Aitken JF, et al. Multilevel determinants of breast cancer survival: association with geographic remoteness and area-level socioeconomic disadvantage. *Breast Cancer Res Treat* 2012;132(2):701-10.

38. Hall S, Holman CD, Sheiner H, et al. The influence of socio-economic and locational disadvantage on survival after a diagnosis of lung or breast cancer in Western Australia. *J Health Serv Res Policy* 2004;9 Suppl 2:10-6.

39. Hsieh JC, Cramb SM, McGree JM, et al. Spatially Varying Coefficient Inequalities: Evaluating How the Impact of Patient Characteristics on Breast Cancer Survival Varies by Location. *PLoS One* 2016;11(5):e0155086.

40. Mitchell KJ, Fritschi L, Reid A, et al. Rural-urban differences in the presentation, management and survival of breast cancer in Western Australia. *Breast* 2006;15(6):769-76.

41. Spilsbury K, Semmens JB, Saunders CM, et al. Long-term survival outcomes following breast cancer surgery in Western Australia. *ANZ J Surg* 2005;75(8):625-30.

42. Supramaniam R, Gibberd A, Dillon A, et al. Increasing rates of surgical treatment and preventing comorbidities may increase breast cancer survival for Aboriginal women. *BMC Cancer* 2014;14(1).

43. Tervonen HE, Aranda S, Roder D, et al. Cancer survival disparities worsening by socio-economic disadvantage over the last 3 decades in new South Wales, Australia. *BMC Public Health* 2017;17(1):691.

44. Tracey E, Roder D, Zorbas H, et al. Survival and degree of spread for female breast cancers in New South Wales from 1980 to 2003: implications for cancer control. *Cancer Causes Control* 2008;19(10):1121-30.

45. Yu XQ, Luo Q, Kahn C, et al. Temporal trends show improved breast cancer survival in Australia but widening urban-rural differences. *Breast* 2015;24(4):524-7.

46. Wilkinson D, Cameron K. Cancer and cancer risk in South Australia: what evidence for a rural-urban health differential? *Aust J Rural Health* 2004;12(2):61-66.

47. Taylor R. Breast cancer five-year survival, by New South Wales regions, 1980 to 1991. *Aust N Z J Public Health* 1997;21(2):206-10.

48. Hsieh JCF, Cramb SM, McGree JM, et al. Does geographic location impact the survival differential between screen- and interval-detected breast cancers? *Stoch Environ Res Risk Assess* 2016;30(1):155-65.

49. Hsieh JC-F, Cramb SM, McGree JM, et al. Bayesian Spatial Analysis for the Evaluation of Breast Cancer Detection Methods. *Aust N Z J Stat* 2014;55(4):351-67.

50. Roder D, Zorbas H, Kollias J, et al. Risk factors for poorer breast cancer outcomes in residents of remote areas of Australia. *Asian Pac J Cancer Prev* 2013;14(1):547-52.

51. Roder D, Zorbas HM, Kollias J, et al. Analysing risk factors for poorer breast cancer outcomes in residents of lower socioeconomic areas of Australia. *Aust Health Rev* 2014;38(2):134-41.

52. Baade PD, Turrell G, Aitken JF. Geographic remoteness, area-level socio-economic disadvantage and advanced breast cancer: a cross-sectional, multilevel study. *J Epidemiol Community Health* 2011;65(11):1037-43.
53. Dasgupta P, Youl PH, Aitken JF, et al. Geographical differences in risk of advanced breast cancer: Limited evidence for reductions over time, Queensland, Australia 1997-2014. *Breast* 2017;36:60-66.
54. Kok DL, Chang JH, Erbas B, et al. Urban-rural differences in the management of screen-detected invasive breast cancer and ductal carcinoma in situ in victoria. *ANZ J Surg* 2006;76(11):996-1001.
55. Depczynski J, Dobbins T, Armstrong B, et al. Stage of diagnosis of prostate, breast and colorectal cancer in farm residents compared with other rural and urban residents in New South Wales. *Aust J Rural Health* 2017.
56. Fox PN, Chatfield MD, Beith JM, et al. Factors delaying chemotherapy for breast cancer in four urban and rural oncology units. *ANZ J Surg* 2013;83(7-8):533-8.
57. Lord SJ, Marinovich ML, Patterson JA, et al. Incidence of metastatic breast cancer in an Australian population-based cohort of women with non-metastatic breast cancer at diagnosis. *Med J Aust* 2012;196(11):688-92.
58. Leung J, Martin J, McLaughlin D. Rural-urban disparities in stage of breast cancer at diagnosis in Australian women. *Aust J Rural Health* 2016;24(5):326-32.
59. Luke C, Nguyen AM, Priest K, et al. Female breast cancers are getting smaller, but socio-demographic differences remain. *Aust N Z J Public Health* 2004;28(4):312-6.
60. AIHW. BreastScreen Australia: monitoring report 2011-2012. Cat. no. CAN 83 Australian Institute of Health and Welfare, Canberra; 2014 [Available from: <http://www.aihw.gov.au/WorkArea/DownloadAsset.aspx?id=60129548882>] accessed 24 February 2015.
61. Leung J, McKenzie S, Martin J, et al. Longitudinal patterns of breast cancer screening: mammography, clinical, and breast self-examinations in a rural and urban setting. *Womens Health Issues* 2014;24(1):e139-46.
62. Leung J, Macleod C, McLaughlin D, et al. Screening mammography uptake within Australia and Scotland in rural and urban populations. *Prev Med* 2015;2:559-62.
63. Barratt AL, Cockburn J, Redman S, et al. Mammographic screening: results from the 1996 National Breast Health Survey. *Med J Aust* 1997;167(10):521-4.
64. Sullivan SG, Glasson EJ, Hussain R, et al. Breast cancer and the uptake of mammography screening services by women with intellectual disabilities. *Prev Med* 2003;37(5):507-12.
65. Weber MF, Chiew M, Feletto E, et al. Cancer screening among immigrants living in urban and regional Australia: Results from the 45 and up study. *Int J Environ Res Public Health* 2014;11(8):8251-66.
66. Schofield PE, Cockburn J, Hill DJ, et al. Encouraging attendance at a screening mammography programme: determinants of response to different recruitment strategies. *J Med Screen* 1994;1(3):144-9.
67. Siahpush M, Singh GK. Sociodemographic variations in breast cancer screening behavior among Australian women: results from the 1995 National Health Survey. *Prev Med* 2002;35(2):174-80.
68. Cockburn J, Sutherland M, Cappiello M, et al. Predictors of attendance at a relocatable mammography service for rural women. *Aust N Z J Public Health* 1997;21(7):739-42.
69. Hughes JP, Jose DC, Tuch GH, et al. Is Step Down Assessment of screen-detected lesions as safe as workup at a Metropolitan Assessment Centre? *Aust N Z J Public Health* 2014;38(1):44-48.



70. O'Byrne AM, Kavanagh AM, Ugoni A, et al. Predictors of non-attendance for second round mammography in an Australian mammographic screening programme. *J Med Screen* 2000;7(4):190-4.

71. NBCC. National Breast Cancer Centre (NBCC). Clinical practice guidelines for management of early breast cancer, 2nd ed. : Canberra: Commonwealth of Australia; 2001 [Available from: [https://www.nhmrc.gov.au/files/nhmrc/publications/attachments/cp74\\_management\\_early\\_breast\\_cancer\\_131223.pdf](https://www.nhmrc.gov.au/files/nhmrc/publications/attachments/cp74_management_early_breast_cancer_131223.pdf)] accessed 24 March 2015.

72. NBOCC. Guide for women with secondary breast cancer: National Breast and Ovarian Cancer Centre (NBOCC). Surry Hills, NSW; 2010 [Available from: <https://canceraustralia.gov.au/publications-and-resources/cancer-australia-publications/guide-women-metastatic-secondary-breast-cancer> ] accessed 24 March 2015.

73. Azzopardi J, Walsh D, Chong C, et al. Impact of geographic location on surgical outcomes of women with breast cancer. *ANZ J Surg* 2014;84(10):735-39.

74. Adelson P, Lim K, Churches T, et al. Surgical treatment of breast cancer in New South Wales 1991, 1992. *Aust N Z J Surg* 1997;67(1):9-14.

75. Martin MA, Meyricke R, O'Neill T, et al. Mastectomy or breast conserving surgery? Factors affecting type of surgical treatment for breast cancer - A classification tree approach. *BMC Cancer* 2006;6.

76. Mastaglia B, Kristjanson LJ. Factors influencing women's decisions for choice of surgery for Stage I and Stage II breast cancer in Western Australia. *J Adv Nurs* 2001;35(6):836-47.

77. Thompson B, Baade P, Coory M, et al. Patterns of surgical treatment for women diagnosed with early breast cancer in Queensland. *Ann Surg Oncol* 2008;15(2):443-51.

78. Baade PD, Dasgupta P, Youl PH, et al. Geographical Inequalities in Surgical Treatment for Localized Female Breast Cancer, Queensland, Australia 1997-2011: Improvements over Time but Inequalities Remain. *Int J Environ Res Public Health* 2016;13(7).

79. Craft PS, Primrose JG, Lindner JA, et al. Surgical management of breast cancer in Australian women in 1993: analysis of Medicare statistics. *Med J Aust* 1997;166(12):626-9.

80. Hill DJ, White VM, Giles GG, et al. Changes in the investigation and management of primary operable breast cancer in Victoria. *Med J Aust* 1994;161(2):110-18.

81. Hall SE, Holman CD, Hendrie DV, et al. Unequal access to breast-conserving surgery in Western Australia 1982-2000. *ANZ J Surg* 2004;74(6):413-9.

82. Koshy A, Buckingham JM, Zhang Y, et al. Surgical management of invasive breast cancer: a 5-year prospective study of treatment in the Australian Capital Territory and South-Eastern New South Wales. *ANZ J Surg* 2005;75(9):757-61.

83. Kriker A, Haskill J, Armstrong BK. Breast conservation, mastectomy and axillary surgery in New South Wales women in 1992 and 1995. *Br J Cancer* 2001;85(5):668-73.

84. Hsieh JC, Cramb SM, McGree JM, et al. Geographic variation in the intended choice of adjuvant treatments for women diagnosed with screen-detected breast cancer in Queensland. *BMC Public Health* 2015;15:1204.

85. Ahern T, Gardner A, Courtney M. Geographical comparisons of information and support needs of Australian women following the primary treatment of breast cancer: a 10-year replication study. *Health Expect* 2015;18(6):2678-92.

86. Chong C, Walters D, de Silva P, et al. Initial axillary surgery: results from the BreastSurgANZ Quality Audit. *ANZ J Surg* 2015;85(10):777-82.



87. Dasgupta P, Youl PH, Pyke C, et al. Sentinel node biopsy for early breast cancer in Queensland, Australia, during 2008-2012. *ANZ J Surg* 2017;10.1111/ans.14047.
88. Morris T, Wetzig N, Sinclair S, et al. Evaluation of implementation of sentinel node biopsy in Australia. *ANZ J Surg* 2012;82(7-8):541-7.
89. Bell RJ, Robinson PJ, Fradkin P, et al. Breast reconstruction following mastectomy for invasive breast cancer is strongly influenced by demographic factors in women in Victoria, Australia. *Breast* 2012;21(3):394-400.
90. Dasgupta P, Youl PH, Pyke C, et al. Geographical disparity in breast reconstruction following mastectomy has reduced over time. *ANZ J Surg* 2017;87(11):E183-E87.
91. Flitcroft K, Brennan M, Costa D, et al. Documenting patterns of breast reconstruction in Australia: The national picture. *Breast* 2016;30:47-53.
92. Roder D, Zorbas H, Kollias J, et al. Factors predictive of immediate breast reconstruction following mastectomy for invasive breast cancer in Australia. *Breast* 2013;22(6):1220-5.
93. Hall SE, Holman CD. Inequalities in breast cancer reconstructive surgery according to social and locational status in Western Australia. *Eur J Surg Oncol* 2003;29(6):519-25.
94. Lai JK, Martin MA, Meyricke R, et al. Factors associated with short-term hospital readmission rates for breast cancer patients in Western Australia: an observational study. *J Am Coll Surg* 2007;204(2):193-200.
95. Ahern T, Gardner A, Courtney M. Exploring patient support by breast care nurses and geographical residence as moderators of the unmet needs and self-efficacy of Australian women with breast cancer: Results from a cross-sectional, nationwide survey. *Eur J Oncol Nurs* 2016;23:72-80.
96. Campbell D, Khan A, Rankin N, et al. Are specialist breast nurses available to Australian women with breast cancer? *Cancer Nurs* 2006;29(1):43-8.
97. Eley RM, Rogers-Clark C, Murray K. The value of a breast care nurse in supporting rural and remote cancer patients in Queensland. *Cancer Nurs* 2008;31(6):E10-8.
98. Budden LM, Hayes BA, Buettner PG. Women's decision satisfaction and psychological distress following early breast cancer treatment: a treatment decision support role for nurses. *Int J Nurs Pract* 2014;20(1):8-16.
99. Ristevski E, Regan M, Birks D, et al. Communicating about breast cancer: rural women's experience of interacting with their surgeon. *Aust J Rural Health* 2012;20(1):22-8.
100. Tulloh BR, Goldsworthy ME. Breast cancer management: a rural perspective. *Med J Aust* 1997;166(1):26-9.
101. Lam J, Cook T, Foster S, et al. Examining Determinants of Radiotherapy Access: Do Cost and Radiotherapy Inconvenience Affect Uptake of Breast-conserving Treatment for Early Breast Cancer? *Clin Oncol (R Coll Radiol)* 2015;27(8):465-71.
102. Collins IM, Lum C, Versace VL. Influence of socioeconomic factors and distance to radiotherapy on breast-conserving surgery rates for early breast cancer in regional Australia; implications of change. *Asia Pac J Clin Oncol* 2017;10.1111/ajco.12828.
103. Albornoz CR, Cordeiro PG, Hishon L, et al. A nationwide analysis of the relationship between hospital volume and outcome for autologous breast reconstruction. *Plast Reconstr Surg* 2013;132(2):192e-200e.
104. Gentil J, Dabakuyo TS, Ouedraogo S, et al. For patients with breast cancer, geographic and social disparities are independent determinants of access to specialized surgeons. A eleven-year population-based multilevel analysis. *BMC Cancer* 2012;12:351.

105. Kong AL, Yen TW, Pezzin LE, et al. Socioeconomic and racial differences in treatment for breast cancer at a low-volume hospital. *Ann Surg Oncol* 2011;18(11):3220-7.

106. Gooiker GA, van Gijn W, Post PN, et al. A systematic review and meta-analysis of the volume-outcome relationship in the surgical treatment of breast cancer. Are breast cancer patients better off with a high volume provider? *Eur J Surg Oncol* 2010;36(Supplement 1):S27-S35.

107. Ess S, Joerger M, Frick H, et al. Predictors of state-of-the-art management of early breast cancer in Switzerland. *Ann Oncol* 2011;22(3):618-24.

108. Hershman DL, Richards CA, Kalinsky K, et al. Influence of health insurance, hospital factors and physician volume on receipt of immediate post-mastectomy reconstruction in women with invasive and non-invasive breast cancer. *Breast Cancer Res Treat* 2012;136(2):535-45.

109. Roder DM, de Silva P, Zorbas HN, et al. Adherence to recommended treatments for early invasive breast cancer: decisions of women attending surgeons in the breast cancer audit of Australia and New Zealand. *Asian Pac J Cancer Prev* 2012;13(4):1675-82.

110. NBOCC. Recommendations for follow-up of women with early breast cancer: National Breast and Ovarian Cancer Centre, (NBOCC): Surry Hills; 2010 [Available from: <https://guidelines.canceraustralia.gov.au/guidelines/early-breast-cancer/>] accessed 24 March 2015.

111. Lauby-Secretan B, Scoccianti C, Loomis D, et al. Breast-cancer screening--viewpoint of the IARC Working Group. *N Engl J Med* 2015;372(24):2353-8.

112. Welch HG, Prorok PC, O'Malley AJ, et al. Breast-Cancer Tumor Size, Overdiagnosis, and Mammography Screening Effectiveness. *N Engl J Med* 2016;375(15):1438-47.

113. Breast Cancer Network Australia. Women living in rural and remote areas 2017 [Available from: <https://www.bcna.org.au/about-us/advocacy/position-statements/women-living-in-rural-and-remote-regions/>] accessed 28 November 2017.

114. Wilcoxon H, Luxford K, Saunders C, et al. Multidisciplinary cancer care in Australia: A national audit highlights gaps in care and medico-legal risk for clinicians. *Asia Pac J Clin Oncol* 2011;7(1):34-40.

115. Cancer Council Australia. Optimal care pathway for women with breast cancer [web page]. 2017 [Available from: <http://www.cancer.org.au/health-professionals/optimal-cancer-care-pathways.html>] accessed 29 November 2017.

116. National Institute for Clinical Excellence. NICE Clinical Guidelines [CG80]- Early and locally advanced breast cancer: diagnosis and treatment [Pdf on Internet]. United Kingdom National Collaborating Centre for Cancer; 2009 [updated February 2009. First:[Available from: <http://www.nice.org.uk/guidance/CG80>] accessed 15 January 2016.

117. Senkus E, Kyriakides S, Ohno S, et al. Primary breast cancer: ESMO Clinical Practice Guidelines for diagnosis, treatment and follow-up. *Ann Oncol* 2015;26 Suppl 5:v8-30.

118. McKevitt EC, Dingee CK, Warburton R, et al. Coordination of radiologic and clinical care reduces the wait time to breast cancer diagnosis. *Curr Oncol* 2017;24(5):e388-e93.

119. Prades J, Remue E, van Hoof E, et al. Is it worth reorganising cancer services on the basis of multidisciplinary teams (MDTs)? A systematic review of the objectives and organisation of MDTs and their impact on patient outcomes. *Health Policy* 2015;119(4):464-74.

120. Taylor C, Shewbridge A, Harris J, et al. Benefits of multidisciplinary teamwork in the management of breast cancer. *Breast Cancer (Dove Med Press)* 2013;5:79-85.

121. Wong A, Snook K, Brennan M, et al. Increasing breast reconstruction rates by offering more women a choice. *ANZ J Surg* 2014;84(1-2):31-36.
122. Rogers MJ, Matheson L, Garrard B, et al. Comparison of outcomes for cancer patients discussed and not discussed at a multidisciplinary meeting. *Public Health* 2017;149:74-80.
123. AIHW. Hospital resources 2015–16: Australian hospital statistics. Health services series no. 78. Cat. no. HSE 190 2017 [Available from: <https://www.aihw.gov.au/getmedia/d37a56cb-dc6b-4b28-a52f-8e00f606ce67/21035.pdf.aspx?inline=true>] accessed 4 December 2017.
124. NBOCC. Recommendations for the management of early breast cancer in women with an identified BRCA1 or BRCA2 gene mutation or at high risk of a gene mutation. : National Breast and Ovarian Cancer Centre, (NBOCC): Surry Hills; 2014 [Available from: <https://canceraustralia.gov.au/publications-and-resources/cancer-australia-publications/recommendations-management-early-breast-cancer-women-identified-brca1-or-brca2-gene-mutation-or-high>] accessed 24 March 2015.
125. NBOCC. Recommendations for use of Sentinel node biopsy in early (operable) breast cancer National Breast and Ovarian Cancer Centre, (NBOCC): Surry Hills; 2008 [Available from: <https://canceraustralia.gov.au/publications-and-resources/cancer-australia-publications/recommendations-use-sentinel-node-biopsy-early-operable-breast-cancer-0>] accessed 24 March 2015.
126. RANZCR. Planning for the Best: Tripartite National Strategic Plan for Radiation Oncology 2012-2022, version 1: The Royal Australian and New Zealand College of Radiologists, Sydney, Australia; 2012 [Available from: <https://www.ranzcr.com/college/document-library/radiation-oncology-tripartite-national-strategic-plan-2012-2022>] accessed 25 April 2015.
127. AIHW. Radiotherapy in Australia 2015–16. HSE 191: Australian Institute of Health and Welfare, Canberra; 2017 [Available from: <https://www.aihw.gov.au/reports/hospitals/radiotherapy-in-australia-2015-16/contents/table-of-contents>] accessed 20 November 2017.
128. Butler SM. Changes to radiotherapy utilisation in Western NSW after the opening of a local service. *J Med Radiat Sci* 2017;10.1002/jmrs.204.
129. Sharma DK, Vangaveti VN, Larkins S. Geographical access to radiation therapy in North Queensland: a retrospective analysis of patient travel to radiation therapy before and after the opening of an additional radiotherapy facility. *Rural Remote Health* 2016;16(1):3640.
130. Darby S, McGale P, Correa C, et al. Effect of radiotherapy after breast-conserving surgery on 10-year recurrence and 15-year breast cancer death: meta-analysis of individual patient data for 10,801 women in 17 randomised trials. *Lancet* 2011;378(9804):1707-16.
131. Early Breast Cancer Trialists' Collaborative Group. Effect of radiotherapy after mastectomy and axillary surgery on 10-year recurrence and 20-year breast cancer mortality: meta-analysis of individual patient data for 8135 women in 22 randomised trials. *Lancet* 2014;383(9935):2127-35.
132. Olson RA, Nichol A, Caron NR, et al. Effect of community population size on breast cancer screening, stage distribution, treatment use and outcomes. *Can J Public Health* 2012;103(1):46-52.
133. Dragun AE, Huang B, Tucker TC, et al. Disparities in the application of adjuvant radiotherapy after breast-conserving surgery for early stage breast cancer: impact on overall survival. *Cancer* 2011;117(12):2590-8.
134. Ess S, Savidan A, Frick H, et al. Geographic variation in breast cancer care in Switzerland. *Cancer Epidemiol* 2010;34(2):116-21.
135. Mac Bride MB, Neal L, Dilaveri CA, et al. Factors Associated with Surgical Decision Making in Women with Early-Stage Breast Cancer: A Literature Review. *J Womens Health* 2013;22(3):236-42.

136. Markossian TW, Hines RB. Disparities in late stage diagnosis, treatment, and breast cancer-related death by race, age, and rural residence among women in Georgia. *Women Health* 2012;52(4):317-35.

137. Zhong T, Fernandes KA, Saskin R, et al. Barriers to Immediate Breast Reconstruction in the Canadian Universal Health Care System. *J Clin Oncol* 2014;32(20):2133-41.

138. Baade PD, Yu XQ, Smith DP, et al. Geographic disparities in prostate cancer outcomes--review of international patterns. *Asian Pac J Cancer Prev* 2015;16(3):1259-75.

139. Chawla N, Butler EN, Lund J, et al. Patterns of colorectal cancer care in Europe, Australia, and New Zealand. *J Natl Cancer Inst Monogr* 2013;2013(46):36-61.

140. AIHW. Australian Cancer Database: Australian Institute of Health & Welfare, Canberra; 2017 [Available from: <https://www.aihw.gov.au/about-our-data/our-data-collections/australian-cancer-database/about-australian-cancer-database>] accessed 12 November 2017.

141. Sabesan S, Kelly J. Are teleoncology models merely about avoiding long distance travel for patients? *Eur J Cancer Care (Engl)* 2014;23(6):745-49.

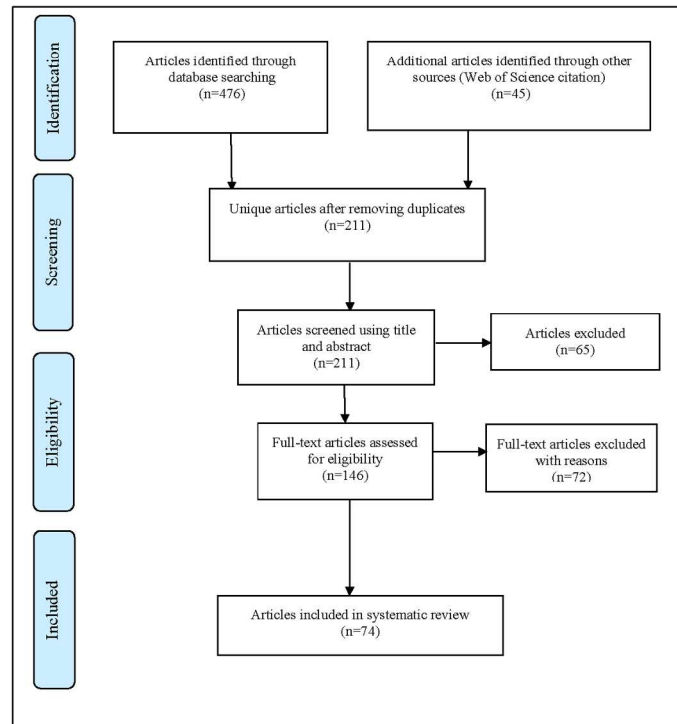


Figure 1

143x186mm (300 x 300 DPI)

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47

**Additional file 1 Database-specific search queries by individual clinical questions**

Electronic databases searched: PubMed (1990- November Week 4, 2017), EMBASE (1990- November Week 4, 2017) and CINAHL (1994- November Week 4, 2017)

All search queries were conducted in a stepwise manner by breaking down each question into key concepts. Each numbered step in Tables below corresponds to the query used for an individual element such as Breast Cancer or Australia. For each element, alternative terms were used to cover all possible synonyms for that component. Finally, the individual search queries were combined to create the final search query using BOOLEAN operators such as “AND” or “OR”.

**1. In women diagnosed with breast cancer, do non-metropolitan women have poorer breast cancer survival compared to metropolitan women in Australia?**

**PUBMED search query**

Search	Query
#1	((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms])
#2	("australia"[MeSH Terms] OR Australia/epidemiology)
#3	((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract]))))))))))))
#4	((((((((((("survival"[MeSH Terms]) OR mortality[MeSH Terms]) OR "survival rate"[MeSH Terms]) OR "disease free survival"[MeSH Terms]) OR excess mortality[MeSH Terms]) OR survival analyses[MeSH Terms]) OR survival analysis[MeSH Terms]) OR cancer-specific survival[MeSH Terms]) OR event free survival[MeSH Terms]
#5	((((((((((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms]) AND (((("australia"[MeSH Terms] OR Australia/epidemiology)))) AND (((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract])))))))))) NOT (((((population, indigenous[MeSH Terms]) OR populations, indigenous[MeSH Terms]) OR oceanic ancestry group[MeSH Terms]))) AND (((((((((((("survival"[MeSH Terms]) OR mortality[MeSH Terms]) OR "survival rate"[MeSH Terms]) OR "disease free survival"[MeSH Terms]) OR excess mortality[MeSH Terms]) OR prognosis[MeSH Terms]) OR survival analyses[MeSH Terms]) OR survival analysis[MeSH Terms]) OR cancer-specific survival[MeSH Terms]) OR event free survival[MeSH Terms]))))

**EMBASE search query (via EBSCO host)**

Search	Query
#1	'breast cancer'/exp OR 'breast cancer'
#2	'australia'/exp
#3	'rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity'
#4	'survival'/exp OR 'survival' OR 'cancer mortality'/exp OR 'cancer mortality'
#5	'breast cancer'/exp OR 'breast cancer' AND 'australia'/exp AND ('rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity') AND ('survival'/exp OR 'survival' OR 'cancer mortality'/exp OR 'cancer mortality') AND [english]/lim AND [female]/lim AND [1990-2015]/py

**CINAHL search query (via EBSCO host)**

Search	Query
S1	(MH "Breast Neoplasms+") OR "breast neoplasm"
S2	(MH "Australia+")
S3	(S1 AND S2)
S4	(MH "Population Characteristics") OR (MH "Rural Health Centers") OR (MH "Hospitals, Rural") OR (MH "Rural Population") OR (MH "Rural Health Services") OR (MH "Rural Areas") OR (MH "Rural Health") OR (MH "Rural Health Nursing") OR (MH "Socioeconomic Factors+") OR (MH "Social Determinants of Health") OR (MH "Healthcare Disparities") OR (MH "Health Status Disparities") OR (MH "Health Services Needs and Demand+") OR TX geography OR TX rural
S5	(MH "Survival") OR (MH "Survival Analysis+") OR (MH "Mortality+") OR TX 'survival'
S6	S3 AND S4 AND S5; English Language; Peer Reviewed; Human

## 2. In women diagnosed with breast cancer, do non-metropolitan women have different socio-demographic characteristics compared to metropolitan women in Australia?

**PUBMED search query**

Search	Query
#1	((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms])
#2	("australia"[MeSH Terms] OR Australia/epidemiology)
#3	((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract])))



Search	Query
#4	((((((((((((((((((((((aged[MeSH Terms]) OR age factors[MeSH Terms]) OR middle aged[MeSH Terms]) OR medicare[MeSH Terms]) OR age group*[MeSH Terms]) OR major medical insurance[MeSH Terms]) OR insurance coverage[MeSH Terms]) OR insurance, health[MeSH Terms]) OR life style*[MeSH Terms]) OR education[Title/Abstract]) OR "occupational status"[MeSH Terms]) OR educational status[MeSH Terms]) OR comorbidities[MeSH Terms]) OR social support[MeSH Terms]) OR marital status[MeSH Terms]) OR risk factors[MeSH Terms]) OR income*[MeSH Terms]) OR health status[MeSH Terms]) OR body mass index*[MeSH Terms]) OR "smoking/epidemiology"[MeSH Terms]) OR "alcohol drinking/epidemiology"[MeSH Terms])))
#5	((((((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms]))) AND (((("australia"[MeSH Terms] OR Australia/epidemiology)))) AND (((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract]))) NOT (((population, indigenous[MeSH Terms]) OR populations, indigenous[MeSH Terms]) OR oceanic ancestry group[MeSH Terms]))) AND (((((((((((((((((((aged[MeSH Terms]) OR age factors[MeSH Terms]) OR middle aged[MeSH Terms]) OR medicare[MeSH Terms]) OR age group*[MeSH Terms]) OR major medical insurance[MeSH Terms]) OR insurance coverage[MeSH Terms]) OR insurance, health[MeSH Terms]) OR life style*[MeSH Terms]) OR education[Title/Abstract]) OR "occupational status"[MeSH Terms]) OR educational status[MeSH Terms]) OR comorbidities[MeSH Terms]) OR social support[MeSH Terms]) OR marital status[MeSH Terms]) OR risk factors[MeSH Terms]) OR income*[MeSH Terms]) OR health status[MeSH Terms]) OR body mass index*[MeSH Terms]) OR "smoking/epidemiology"[MeSH Terms]) OR "alcohol drinking/epidemiology"[MeSH Terms]))) AND incidence[MeSH Terms])

EMBASE search query (via EBSCO host)

Search	Query
#1	'breast cancer'/exp OR 'breast cancer'
#2	'australia'/exp
#3	'rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'demography'/exp OR 'demography' OR 'socioeconomics'/exp OR 'socioeconomics' OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health disparity' OR 'health care disparity'/exp OR 'health care disparity'
#4	(age OR 'risk factor' OR 'lifestyle' OR 'health insurance' OR 'comorbidity') AND ('incidence'/exp OR 'incidence')
#5	'breast cancer'/exp OR 'breast cancer' AND 'australia'/exp AND ('rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'demography'/exp OR 'demography' OR 'socioeconomics'/exp OR 'socioeconomics' OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health disparity' OR 'health care disparity'/exp OR 'health care disparity') AND (age OR 'risk factor' OR 'lifestyle' OR 'health insurance' OR 'comorbidity') AND ('incidence'/exp OR 'incidence') AND [english]/lim AND [female]/lim AND [1990-2015]/py

CINAHL search query (via EBSCO host)

Search	Query
S1	(MH "Breast Neoplasms+") OR "breast neoplasm"
S2	(MH "Australia+")
S3	(S1 AND S2)

Search	Query
S4	(MH "Population Characteristics") OR (MH "Rural Health Centers") OR (MH "Hospitals, Rural") OR (MH "Rural Population") OR (MH "Rural Health Services") OR (MH "Rural Areas") OR (MH "Rural Health") OR (MH "Rural Health Nursing") OR (MH "Socioeconomic Factors+") OR (MH "Social Determinants of Health") OR (MH "Healthcare Disparities") OR (MH "Health Status Disparities") OR (MH "Health Services Needs and Demand+") OR TX geography OR TX rural
S5	(MH "Middle Age") OR (MH "Age Factors") OR (MH "Life Style+") OR (MH "Risk Factors+") OR (MH "Insurance, Health+") OR (MH "Insurance, Health+") OR (MH "Marital Status+") (MH "Demography+") OR (MH "Residence Characteristics+") OR (MH "Geographic Factors") OR (MH "Comorbidity") OR "comorbidities"
S6	S3 AND S4 AND S5; English Language; Peer Reviewed; Human

### 3. In women diagnosed with breast cancer, do non-metropolitan women have more advanced tumour characteristics compared to metropolitan women in Australia?

#### PUBMED search query

Search	Query
#1	((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms])
#2	("australia"[MeSH Terms] OR Australia/epidemiology)
#3	((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR ((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract]) )))))))
#4	((((((((((((((((((("neoplasm staging/epidemiology"[MeSH Terms]) OR pathology, clinical[MeSH Terms]) OR diagnostic molecular pathology[MeSH Terms]) OR stage[Title/Abstract]) OR advanced[Title/Abstract]) OR early[Title/Abstract]) OR spread[Title/Abstract]) OR large[Title/Abstract]) OR size[Title/Abstract]) OR grade[Title/Abstract]) OR bifocal[Title/Abstract]) OR multifocal[Title/Abstract]) OR neoplasm metastases[MeSH Terms]) OR neoplasm metastasis[MeSH Terms]) OR lymphatic metastasis[MeSH Terms]) ))
#5	((((((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms]))) AND (((("australia"[MeSH Terms] OR Australia/epidemiology)))) AND (((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR ((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract]) ))))))) NOT (((((population, indigenous[MeSH Terms]) OR populations, indigenous[MeSH Terms]))) AND (((((((((((((((((((("neoplasm staging/epidemiology"[MeSH Terms]) OR pathology, clinical[MeSH Terms]) OR diagnostic molecular pathology[MeSH Terms]) OR stage[Title/Abstract]) OR advanced[Title/Abstract]) OR early[Title/Abstract]) OR spread[Title/Abstract]) OR large[Title/Abstract]) OR size[Title/Abstract]) OR grade[Title/Abstract]) OR bifocal[Title/Abstract]) OR multifocal[Title/Abstract]) OR "multiple primaries"[Text Word]) OR neoplasm metastases[MeSH Terms]) OR neoplasm metastasis[MeSH Terms]) OR lymphatic metastasis[MeSH Terms]) )))) NOT ((((((quality of life[MeSH Terms]) OR "survivors/psychology"[MeSH Terms]) OR genes, brca1[MeSH Terms]) OR genes, brca2[MeSH Terms]) OR brca1 gene[MeSH Terms]) OR brca2 gene[MeSH Terms]) OR BRCA*[Text Word]))

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47

**EMBASE search query (via EBSCO host)**

Search	Query
#1	'breast cancer'/exp OR 'breast cancer'
#2	'australia'/exp
#3	'rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity'
#4	'cancer staging'/exp OR 'cancer staging' OR 'cancer grading' OR 'cancer size' OR 'metastasis'/exp OR 'metastasis'
#5	'breast cancer'/exp OR 'breast cancer' AND 'australia'/exp AND ('rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity') AND ('cancer staging'/exp OR 'cancer staging' OR 'cancer grading' OR 'cancer size' OR 'metastasis'/exp OR 'metastasis') AND [english]/lim AND [female]/lim AND [1990-2015]/py

**CINAHL search query (via EBSCO host)**

Search	Query
S1	(MH "Breast Neoplasms+") OR "breast neoplasm"
S2	(MH "Australia+")
S3	(S1 AND S2)
S4	(MH "Population Characteristics") OR (MH "Rural Health Centers") OR (MH "Hospitals, Rural") OR (MH "Rural Population") OR (MH "Rural Health Services") OR (MH "Rural Areas") OR (MH "Rural Health") OR (MH "Rural Health Nursing") OR (MH "Socioeconomic Factors+") OR (MH "Social Determinants of Health") OR (MH "Healthcare Disparities") OR (MH "Health Status Disparities") OR (MH "Health Services Needs and Demand+") OR TX geography OR TX rural
S5	(MM "Neoplasm Staging") OR (MM "Neoplasms, Multiple Primary+") OR AB 'cancer grade' OR "cancer stage"
S6	S3 AND S4 AND S5; English Language; Peer Reviewed; Human

**4. In women diagnosed with breast cancer, are non-metropolitan women in the breast screening target group less likely to access breast cancer screening services compared to metropolitan women in Australia?**

**PUBMED search query**

Search	Query
#1	((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms])
#2	("australia"[MeSH Terms] OR Australia/epidemiology)
#3	((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract]) ))))))))

Search	Query
#4	((((((((((cancer screening[MeSH Terms]) OR "mammography/utilization"[MeSH Terms]) OR "screening rates"[Text Word]) OR "mammography/statistics and numerical data"[MeSH Terms]) OR mass screening[MeSH Terms]) OR BreastScreen[Title/Abstract] ))))))
#5	((((((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms]))) AND (((("australia"[MeSH Terms] OR Australia/epidemiology)))) AND (((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract]))))) NOT (((((population, indigenous[MeSH Terms]) OR populations, indigenous[MeSH Terms]))) AND (((((((((((cancer screening[MeSH Terms]) OR "mammography/utilization"[MeSH Terms]) OR "screening rates"[Text Word]) OR "mammography/statistics and numerical data"[MeSH Terms]) OR mass screening[MeSH Terms]) OR BreastScreen[Title/Abstract] ))))))

#### EMBASE search query (via EBSCO host)

Search	Query
#1	'breast cancer'/exp OR 'breast cancer'
#2	'australia'/exp
#3	'rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity'
#4	'mammography'/exp OR 'mammography' OR 'cancer screening'/exp)
#5	'breast cancer'/exp OR 'breast cancer' AND 'australia'/exp AND ('rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity') AND ('mammography'/exp OR 'mammography' OR 'cancer screening'/exp) AND (rate* OR utiliz*) AND [english]/lim AND [female]/lim AND [1990-2015]/py

#### CINAHL search query (via EBSCO host)

Search	Query
S1	(MH "Breast Neoplasms+") OR "breast neoplasm"
S2	(MH "Australia+")
S3	(S1 AND S2)
S4	(MH "Population Characteristics") OR (MH "Rural Health Centers") OR (MH "Hospitals, Rural") OR (MH "Rural Population") OR (MH "Rural Health Services") OR (MH "Rural Areas") OR (MH "Rural Health") OR (MH "Rural Health Nursing") OR (MH "Socioeconomic Factors+") OR (MH "Social Determinants of Health") OR (MH "Healthcare Disparities") OR (MH "Health Status Disparities") OR (MH "Health Services Needs and Demand+") OR TX geography OR TX rural
S5	(MH "Mammography") OR (MH "Cancer Screening")
S6	S3 AND S4 AND S5; English Language; Peer Reviewed; female

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47

5. In women diagnosed with breast cancer, are non-metropolitan women in the breast screening target group less likely to adhere to recommended breast cancer screening intervals (2 yearly) compared to metropolitan women in Australia?

PUBMED search query

Search	Query
#1	((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms])
#2	("australia"[MeSH Terms] OR Australia/epidemiology)
#3	((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract])))
#4	((((((((((((((cancer screening[MeSH Terms]) OR mammography/epidemiology[MeSH Terms]) OR "mammography/utilization"[MeSH Terms]) OR ("mammography/statistics and numerical data"[MeSH Terms]) OR "screening intervals"[Text Word]) OR "second round"[Text Word]) OR "adherence"[Text Word]) OR "non-attendance"[Text Word])))
#5	((((((((((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms]))) AND (((("australia"[MeSH Terms] OR Australia/epidemiology)))) AND (((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract]))) AND (((((((((((cancer screening[MeSH Terms]) OR mammography/epidemiology[MeSH Terms]) OR "mammography/utilization"[MeSH Terms]) OR ("mammography/statistics and numerical data"[MeSH Terms]) OR "screening intervals"[Text Word]) OR "second round"[Text Word]) OR "adherence"[Text Word]) OR "non-attendance"[Text Word]))) NOT (((populations, indigenous[MeSH Terms]) OR Chinese[Text Word]) OR brca*[Title/Abstract]) OR advertis* [Title/Abstract]))

EMBASE search query (via EBSCO host)

Search	Query
#1	'breast cancer'/exp OR 'breast cancer'
#2	'australia'/exp
#3	'rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity'
#4	'mammography'/exp OR 'mammography' OR 'cancer screening'/exp)
#5	'breast cancer'/exp OR 'breast cancer' AND 'australia'/exp AND ('rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity') AND ('mammography'/exp/mj OR 'mammography' OR 'cancer screening'/exp) AND (rescreen* OR second* OR return*) AND [english]/lim AND [female]/lim AND [1990-2015]/py

**CINAHL search query (via EBSCO host)**

Search	Query
S1	(MH "Breast Neoplasms+") OR "breast neoplasm"
S2	(MH "Australia+")
S3	(S1 AND S2)
S4	(MH "Population Characteristics") OR (MH "Rural Health Centers") OR (MH "Hospitals, Rural") OR (MH "Rural Population") OR (MH "Rural Health Services") OR (MH "Rural Areas") OR (MH "Rural Health") OR (MH "Rural Health Nursing") OR (MH "Socioeconomic Factors+") OR (MH "Social Determinants of Health") OR (MH "Healthcare Disparities") OR (MH "Health Status Disparities") OR (MH "Health Services Needs and Demand+") OR TX geography OR TX rural
S5	(MH "Mammography") OR (MH "Cancer Screening")
S6	TX rescreen* OR TX "mammography second"
S7	S3 AND S4 AND S5 AND S6; English Language; Peer Reviewed; female

**6. In women diagnosed with breast cancer, are there differences in clinical management between non-metropolitan and metropolitan women in Australia?**

**PUBMED search query**

Search	Query
#1	((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms])
#2	("australia"[MeSH Terms] OR Australia/epidemiology)
#3	((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract]) ))))))))
#4	((((((((((((((((((lymph node excision/statistics and numerical data"[MeSH Terms])) OR adjuvant radiotherapy[MeSH Terms]) OR adjuvant chemotherapy[MeSH Terms]) OR neoadjuvant[MeSH Terms]) OR mastectomy[MeSH Terms]) OR breast conserving surgeries[MeSH Terms]) OR breast conserving surgery[MeSH Terms]) OR reconstruction, breast[MeSH Terms]) OR clinical audit[MeSH Terms]) OR clinical audits[MeSH Terms]) OR "clinical management"[Text Word]) OR cancer treatment protocol[Text Word]) OR "hormonal therapy"[Text Word] OR "sentinel node biopsy"[Text Word] ))))))
#5	((((((((((((((((((breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms])))) AND (((australia"[MeSH Terms] OR Australia/epidemiology))) AND (((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract]) )))))))) AND (((((((((((((((((((lymph node excision/statistics and numerical data"[MeSH Terms]) OR adjuvant radiotherapy[MeSH Terms]) OR adjuvant chemotherapy[MeSH Terms]) OR neoadjuvant[MeSH Terms]) OR mastectomy[MeSH Terms]) OR breast conserving surgeries[MeSH Terms]) OR breast conserving surgery[MeSH Terms]) OR reconstruction, breast[MeSH Terms]) OR clinical audit[MeSH Terms]) OR clinical audits[MeSH Terms]) OR "clinical management"[Text Word]) OR cancer treatment protocol[Text Word]) OR "hormonal therapy"[Text Word] OR "sentinel node biopsy"[Text Word] ))))))

EMBASE search query (via EBSCO host)

Search	Query
#1	'breast cancer'/exp OR 'breast cancer'
#2	'australia'/exp
#3	'rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity'
#4	'clinical practice'/exp OR 'cancer adjuvant chemotherapy'/exp OR 'cancer chemotherapy'/exp OR 'cancer radiotherapy'/exp OR 'cancer hormonal therapy'/exp OR 'mastectomy'/exp OR 'mastectomy' OR 'lymph node dissection'/exp OR 'breast reconstruction'/exp OR 'breast reconstruction' OR 'cancer therapy multimodality'/exp
#5	'breast cancer'/exp OR 'breast cancer' AND 'australia'/exp AND ('rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity') AND ('clinical practice'/exp OR 'cancer adjuvant chemotherapy'/exp OR 'cancer chemotherapy'/exp OR 'cancer radiotherapy'/exp OR 'cancer hormonal therapy'/exp OR 'mastectomy'/exp OR 'mastectomy' OR 'lymph node dissection'/exp OR 'breast reconstruction'/exp OR 'breast reconstruction' OR 'cancer therapy multimodality'/exp) AND [english]/lim AND [female]/lim AND [1990-2015]/py

CINAHL search query (via EBSCO host)

Search	Query
S1	(MH "Breast Neoplasms+") OR "breast neoplasm"
S2	(MH "Australia+")
S3	(S1 AND S2)
S4	(MH "Population Characteristics") OR (MH "Rural Health Centers") OR (MH "Hospitals, Rural") OR (MH "Rural Population") OR (MH "Rural Health Services") OR (MH "Rural Areas") OR (MH "Rural Health") OR (MH "Rural Health Nursing") OR (MH "Socioeconomic Factors+") OR (MH "Social Determinants of Health") OR (MH "Healthcare Disparities") OR (MH "Health Status Disparities") OR (MH "Health Services Needs and Demand+") OR TX geography OR TX rural
S5	(MH "Mastectomy+") OR (MH "Lumpectomy") OR (MH "Chemotherapy, Cancer+") OR (MH "Chemotherapy, Adjuvant") OR (MH "Radiotherapy, Cancer+") OR (MH "Radiotherapy, Adjuvant") OR (MH "Combined Modality Therapy+") OR (MH "Breast Reconstruction") OR "Surgical patterns" or "case management"
S6	S3 AND S4 AND S5; English Language; Peer Reviewed; female

7. In women diagnosed with breast cancer, are non-metropolitan women less likely to receive the recommended clinical management compared to metropolitan women in Australia

PUBMED search query

Search	Query
#1	((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms])
#2	("australia"[MeSH Terms] OR Australia/epidemiology)



Search	Query
#3	((((((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract])))
#4	((((((((((((((((((((((("lymph node excision/statistics and numerical data"[MeSH Terms]) OR adjuvant radiotherapy[MeSH Terms]) OR adjuvant chemotherapy[MeSH Terms]) OR neoadjuvant[MeSH Terms]) OR "sentinel node biopsy"[Text Word]) OR "hormonal therapy"[Text Word] OR (((chemotherapy[Text Word]) OR radiotherapy[Text Word])
#5	((((((((((((((((((((((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms]))) AND (((("australia"[MeSH Terms] OR Australia/epidemiology))) AND (((((((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract]))) AND (((((((((((((((((((((((("lymph node excision/statistics and numerical data"[MeSH Terms]) OR adjuvant radiotherapy[MeSH Terms]) OR adjuvant chemotherapy[MeSH Terms]) OR neoadjuvant[MeSH Terms]) OR "sentinel node biopsy"[Text Word]) OR "hormonal therapy"[Text Word] OR (((chemotherapy[Text Word]) OR radiotherapy[Text Word])

#### EMBASE search query (via EBSCO host)

Search	Query
#1	'breast cancer'/exp OR 'breast cancer'
#2	'australia'/exp
#3	'rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity'
#4	'cancer adjuvant chemotherapy'/exp OR 'cancer adjuvant chemotherapy' OR 'cancer chemotherapy'/exp OR 'cancer chemotherapy' OR 'cancer combination chemotherapy'/exp OR 'cancer combination chemotherapy' OR 'cancer radiotherapy'/exp OR 'cancer radiotherapy' OR 'cancer hormonal therapy'/exp OR 'cancer hormonal therapy' OR 'lymph node dissection'/exp OR 'lymph node dissection' OR 'cancer therapy'/exp OR 'sentinel node biopsy' OR 'cancer therapy multimodality'/exp OR 'cancer therapy multimodality'
#5	'breast cancer'/exp OR 'breast cancer' AND 'australia'/exp AND ('rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity') AND ('cancer adjuvant chemotherapy'/exp OR 'cancer adjuvant chemotherapy' OR 'cancer chemotherapy'/exp OR 'cancer chemotherapy' OR 'cancer combination chemotherapy'/exp OR 'cancer combination chemotherapy' OR 'cancer radiotherapy'/exp OR 'cancer radiotherapy' OR 'cancer hormonal therapy'/exp OR 'cancer hormonal therapy' OR 'lymph node dissection'/exp OR 'lymph node dissection' OR 'cancer therapy'/exp OR 'sentinel node biopsy' OR 'cancer therapy multimodality'/exp OR 'cancer therapy multimodality') AND [english]/lim AND [female]/lim AND [1990-2015]/py

#### CINAHL search query (via EBSCO host)

Search	Query
S1	(MH "Breast Neoplasms+") OR "breast neoplasm"

10

Search	Query
S2	(MH "Australia+")
S3	(S1 AND S2)
S4	(MH "Population Characteristics") OR (MH "Rural Health Centers") OR (MH "Hospitals, Rural") OR (MH "Rural Population") OR (MH "Rural Health Services") OR (MH "Rural Areas") OR (MH "Rural Health") OR (MH "Rural Health Nursing") OR (MH "Socioeconomic Factors+") OR (MH "Social Determinants of Health") OR (MH "Healthcare Disparities") OR (MH "Health Status Disparities") OR (MH "Health Services Needs and Demand+") OR TX geography OR TX rural
S5	(MH "Chemotherapy, Cancer+") OR (MH "Chemotherapy, Adjuvant") OR (MH "Radiotherapy, Cancer+") OR (MH "Radiotherapy, Adjuvant") OR (MH "Combined Modality Therapy+") OR (MH "Breast Reconstruction")
S6	S3 AND S4 AND S5; English Language; Peer Reviewed; female

8. In women diagnosed with breast cancer, are non-metropolitan women more likely to experience delays in referral to breast cancer specialist clinicians compared to metropolitan women in Australia?

PUBMED search query

Search	Query
#1	((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms])
#2	("australia"[MeSH Terms] OR Australia/epidemiology)
#3	((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract]) )))))))
#4	((((((((((((((((((referral and consultation[MeSH Terms]) OR physician's practice patterns[MeSH Terms]) OR ("hospitals, rural/statistics and numerical data"[MeSH Terms])) OR ("geography, medical/statistics and numerical data"[MeSH Terms])) OR "hospitals, high volume"[MeSH Terms]) OR "hospitals, low volume"[MeSH Terms]) OR oncologist[Title/Abstract]) OR caseload[Title/Abstract]) OR "low caseload"[Text Word]) OR "high caseload"[MeSH Terms]) OR specialist[MeSH Terms]) OR "hospitals, public"[MeSH Terms]) OR "hospitals, private"[MeSH Terms]) OR "specialties, surgical/epidemiology"[MeSH Terms])
#5	((((((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms])))) AND (((("australia"[MeSH Terms] OR Australia/epidemiology)))) AND (((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract]) ))))))) NOT (((((population, indigenous[MeSH Terms]) OR populations, indigenous[MeSH Terms])))) AND (((((((((((((((((((referral and consultation[MeSH Terms]) OR physician's practice patterns[MeSH Terms]) OR ("hospitals, rural/statistics and numerical data"[MeSH Terms])) OR "hospitals, high volume"[MeSH Terms]) OR "hospitals, low volume"[MeSH Terms]) OR oncologist[Title/Abstract]) OR caseload[Title/Abstract]) OR "low caseload"[Text Word]) OR "high caseload"[MeSH Terms]) OR specialist[MeSH Terms]) OR "hospitals, public"[MeSH Terms]) OR "hospitals, private"[MeSH Terms]) OR "specialties, surgical/epidemiology"[MeSH Terms] NOT screen*[Text Word])) NOT interventio*[Text Word])

**EMBASE search query (via EBSCO host)**

Search	Query
#1	'breast cancer'/exp OR 'breast cancer'
#2	'australia'/exp
#3	'rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity'
#4	'referral and consultation'/exp OR 'referral and consultation' OR 'public hospitals' OR 'private hospitals' OR (surgical AND caseload) OR 'hospital volume' OR 'surgical volume'
#5	'breast cancer'/exp OR 'breast cancer' AND 'australia'/exp AND ('rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity') AND ('referral and consultation'/exp OR 'referral and consultation' OR 'public hospitals' OR 'private hospitals' OR (surgical AND caseload) OR 'hospital volume' OR 'surgical volume') AND [english]/lim AND [female]/lim AND [1990-2015]/py

**CINAHL search query (via EBSCO host)**

Search	Query
S1	(MH "Breast Neoplasms+") OR "breast neoplasm"
S2	(MH "Australia+")
S3	(S1 AND S2)
S4	(MH "Population Characteristics") OR (MH "Rural Health Centers") OR (MH "Hospitals, Rural") OR (MH "Rural Population") OR (MH "Rural Health Services") OR (MH "Rural Areas") OR (MH "Rural Health") OR (MH "Rural Health Nursing") OR (MH "Socioeconomic Factors+") OR (MH "Social Determinants of Health") OR (MH "Healthcare Disparities") OR (MH "Health Status Disparities") OR (MH "Health Services Needs and Demand+") OR TX geography OR TX rural
S5	(MH "Referral and Consultation+")
S6	S3 AND S4 AND S5; English Language; Peer Reviewed; female

**9. In women diagnosed with breast cancer, do non-metropolitan women experience fewer treatment options compared to metropolitan women in Australia?****PUBMED search query**

Search	Query
#1	((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms])
#2	("australia"[MeSH Terms] OR Australia/epidemiology)
#3	((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract]))))))))))))

Search	Query
#4	((((((((((((((travel times[MeSH Terms]) OR travel[MeSH Terms]) OR choice behavior*[MeSH Terms]) OR "waiting lists"[MeSH Terms]) OR cost, treatment[MeSH Terms]))) OR time factor[MeSH Terms]) OR time factors[MeSH Terms]) OR (health services needs and demands[MeSH Terms] OR ((patient satisfaction[MeSH Terms]) OR choice*[Title/Abstract]) OR decision[Title/Abstract]))
#5	((((((((((((((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms]))) AND (((("australia"[MeSH Terms] OR Australia/epidemiology)))) AND (((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract])))) NOT (((((population, indigenous[MeSH Terms]) OR populations, indigenous[MeSH Terms])))) AND (((((((((((((((travel times[MeSH Terms]) OR travel[MeSH Terms]) OR choice behavior*[MeSH Terms]) OR "waiting lists"[MeSH Terms]) OR cost, treatment[MeSH Terms]) OR time factor[MeSH Terms]) OR time factors[MeSH Terms]) OR (health services needs and demands[MeSH Terms] OR ((patient satisfaction[MeSH Terms]) OR choice*[Title/Abstract]) OR decision[Title/Abstract]) NOT (((((screen*[Title/Abstract]) OR brca*[Title/Abstract]) OR BRCA*[Title/Abstract]) OR mammogr*[Title/Abstract]) OR follow-up[Title/Abstract]))

EMBASE search query (via EBSCO host)

Search	Query
#1	'breast cancer'/exp OR 'breast cancer'
#2	'australia'/exp
#3	'rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity'
#4	'patient decision making'/exp OR 'patient decision making' OR 'patient decision aid' OR 'patient delay'
#5	'breast cancer'/exp OR 'breast cancer' AND 'australia'/exp AND ('rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity') AND 'patient decision making'/exp OR 'patient decision making' OR 'patient decision aid' OR 'patient delay' AND [english]/lim AND [female]/lim AND [1990-2015]/py

CINAHL search query (via EBSCO host)

Search	Query
S1	(MH "Breast Neoplasms+") OR "breast neoplasm"
S2	(MH "Australia+")
S3	(S1 AND S2)
S4	(MH "Population Characteristics") OR (MH "Rural Health Centers") OR (MH "Hospitals, Rural") OR (MH "Rural Population") OR (MH "Rural Health Services") OR (MH "Rural Areas") OR (MH "Rural Health") OR (MH "Rural Health Nursing") OR (MH "Socioeconomic Factors+") OR (MH "Social Determinants of Health") OR (MH "Healthcare Disparities") OR (MH "Health Status Disparities") OR (MH "Health Services Needs and Demand+") OR TX geography OR TX rural
S5	(MH "Decision Making, Patient+")
S6	S3 AND S4 AND S5; English Language; Peer Reviewed; female

# **10. In women diagnosed with breast cancer, are non-metropolitan women less likely to complete prescribed treatment compared to metropolitan women in Australia?**

## **PUBMED search query**

Search	Query
#1	((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms])
#2	("australia"[MeSH Terms] OR Australia/epidemiology)
#3	((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract])))
#4	((((((((((((((((((("hospitals, rural/statistics and numerical data"[MeSH Terms])) OR patient compliance[MeSH Terms]) OR compliance, patient[MeSH Terms]) OR compliance, protocol[MeSH Terms]) OR non compliance, patient[MeSH Terms]) OR patient acceptance of health care[MeSH Terms]) OR patient participation[MeSH Terms])) OR clinical audit*[MeSH Terms]) OR treatment refusal[MeSH Terms])
#5	((((((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms]))) AND (((("australia"[MeSH Terms] OR Australia/epidemiology)))) ((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract]))) NOT (((((population, indigenous[MeSH Terms]) OR populations, indigenous[MeSH Terms])))) AND (((((((((((((((((((("hospitals, rural/statistics and numerical data"[MeSH Terms])) OR patient compliance[MeSH Terms]) OR compliance, patient[MeSH Terms]) OR compliance, protocol[MeSH Terms]) OR non compliance, patient[MeSH Terms]) OR patient acceptance of health care[MeSH Terms]) OR patient participation[MeSH Terms])) OR clinical audit*[MeSH Terms]) OR treatment refusal[MeSH Terms])

## **EMBASE search query (via EBSCO host)**

Search	Query
#1	'breast cancer'/exp OR 'breast cancer'
#2	'australia'/exp
#3	'rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity'
#4	'patient compliance'/exp OR 'patient compliance' OR 'treatment refusal'/exp OR 'treatment refusal'
#5	'breast cancer'/exp OR 'breast cancer' AND 'australia'/exp AND ('rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity') AND ('patient compliance'/exp OR 'patient compliance' OR 'treatment refusal'/exp OR 'treatment refusal') AND [english]/lim AND [female]/lim AND [1990-2015]/py

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47

CINAHL search query (via EBSCO host)

Search	Query
S1	(MH "Breast Neoplasms+") OR "breast neoplasm"
S2	(MH "Australia+")
S3	(S1 AND S2)
S4	(MH "Population Characteristics") OR (MH "Rural Health Centers") OR (MH "Hospitals, Rural") OR (MH "Rural Population") OR (MH "Rural Health Services") OR (MH "Rural Areas") OR (MH "Rural Health") OR (MH "Rural Health Nursing") OR (MH "Socioeconomic Factors+") OR (MH "Social Determinants of Health") OR (MH "Healthcare Disparities") OR (MH "Health Status Disparities") OR (MH "Health Services Needs and Demand+") OR TX geography OR TX rural
S5	(MH "Patient Compliance+") OR (MH "Treatment Refusal")
S6	S3 AND S4 AND S5; English Language; Peer Reviewed; female

11. In women diagnosed with breast cancer, are non-metropolitan women less likely to participate in recommended follow-up compared to metropolitan women in Australia?

PUBMED search query

Search	Query
#1	((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms])
#2	("australia"[MeSH Terms] OR Australia/epidemiology)
#3	((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract]) ))))))))
#4	((((((((((((((((((survivorship[MeSH Terms]) OR long term survivors[MeSH Terms]) OR "survivorship care"[Title/Abstract]) OR "survivorship plans"[Title/Abstract]) OR long term care[MeSH Terms]) ))))))))
#5	((((((((((("breast neoplasms"[MeSH Terms]) OR Breast Tumors[MeSH Terms]) OR Breast Cancer[MeSH Terms]) OR Breast Carcinoma[MeSH Terms]) )))) AND (((("australia"[MeSH Terms] OR Australia/epidemiology)))) AND (((((((((((((((((((socioeconomic factors[MeSH Terms]) OR residence characteristics[MeSH Terms]) OR geography*[MeSH Terms]) OR spatial analysis[MeSH Terms]) OR spatio-temporal analysis[MeSH Terms]) OR geographic mapping[MeSH Terms]) OR rural health*[MeSH Terms]) OR rural population*[MeSH Terms]) OR health status disparities*[MeSH Terms]) OR healthcare disparities*[MeSH Terms]) OR small-area analysis[MeSH Terms] OR health services accessibility [MeSH Terms]) OR (((non-metropolitan[Title/Abstract]) OR rural[Title/Abstract]) )))))) NOT (((((population, indigenous[MeSH Terms]) OR populations, indigenous[MeSH Terms]) )))) AND (((((((((((((((((((survivorship[MeSH Terms]) OR long term survivors[MeSH Terms]) OR "survivorship care"[Title/Abstract]) OR "survivorship plans"[Title/Abstract]) OR long term care[MeSH Terms]) )))))) NOT (((quality of life[MeSH Terms]) OR asian continental ancestry group[MeSH Terms]) OR stress, psychological[MeSH Terms]))

**EMBASE search query (via EBSCO host)**

Search	Query
#1	'breast cancer'/exp OR 'breast cancer'
#2	'australia'/exp
#3	'rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity'
#4	'postoperative care'/exp OR 'postoperative care' OR 'patient care'/exp OR 'patient care' OR 'survivorship' OR 'survivorship care plan'
#5	'breast cancer'/exp OR 'breast cancer' AND 'australia'/exp/mj AND ('rural health care'/exp OR 'rural health care' OR 'rural population'/exp OR 'rural population' OR 'urban rural difference'/exp OR 'urban rural difference' OR 'socioeconomics'/exp OR 'medical geography'/exp OR 'medical geography' OR 'health disparity'/exp OR 'health care disparity'/exp OR 'health care disparity') AND ('postoperative care'/exp OR 'postoperative care' OR 'patient care'/exp OR 'patient care' OR 'survivorship' OR 'survivorship care plan') AND [english]/lim AND [female]/lim AND [humans]/lim

**CINAHL search query (via EBSCO host)**

Search	Query
S1	(MH "Breast Neoplasms+") OR "breast neoplasm"
S2	(MH "Australia+")
S3	(S1 AND S2)
S4	(MH "Population Characteristics") OR (MH "Rural Health Centers") OR (MH "Hospitals, Rural") OR (MH "Rural Population") OR (MH "Rural Health Services") OR (MH "Rural Areas") OR (MH "Rural Health") OR (MH "Rural Health Nursing") OR (MH "Socioeconomic Factors+") OR (MH "Social Determinants of Health") OR (MH "Healthcare Disparities") OR (MH "Health Status Disparities") OR (MH "Health Services Needs and Demand+") OR TX geography OR TX rural
S5	(MH "Postoperative Care+") OR (MH "Patient Care+") OR (MH "After Care")
S6	S3 AND S4 AND S5; English Language; Peer Reviewed; female

**Additional searches:**

We also searched the INFORMIT database (1994- March Week 1, 2015)

**Informit Health (Australian databases) search query**

Search	Query
#1	(Breast Cancer) OR (Breast Neoplasm)
#2	MH: Australia
#3	( MH:Australia) AND ( (Breast Cancer) OR (Breast Neoplasm))
#4	(( MH:Australia) AND ( (Breast Cancer) OR (Breast Neoplasm))) AND (( ALLTERMS:rural OR geography OR (rural health) OR socioeconomic OR inequalities ) )



1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

**Additional file 2: Quality appraisal tools for included quantitative studies**

<b>I. Selection bias (Sample selection for cohort studies)</b>	<b>Score</b>
Representative of population of interest	2
Selected group, somewhat representative	1
Highly selected, convenient or not described	0
<b>II. Assessment (or measurement) of exposure and or confounding variables</b>	
Secure records, independent blind assessment	2
Independent assessment un-blinded; self-reported	1
No description or unclear how exposure was assessed	0
<b>III. Assessment (or measurement) of outcome</b>	
Record linkage, independent blind assessment, previously validated/reliable measures	2
Independent assessment un-blinded; self-report, novel measures (validation/ reliability data provided	1
Novel measures (no validation/reliability tests) or assessment of outcome not described	0
<b>IV. Adequacy of follow-up and/or were all patients included</b>	
Yes (follow-up > 95%) of patients or > 95% of all patients included	2
Reasonable follow-up of all patients or all patients included (>80%)	1
≤ 80% of patients /included patients followed-up, not described or not relevant	0
<b>V. Adequacy of adjustment for confounding: (matching, stratification, multivariate analysis</b>	
Yes	2
Not clear or not applicable	1
No	0
<b>VI. If there was adjustment for residual confounding</b>	
Study comprehensively controls for age and additional risk factors	2
Study controls for age and most plausible additional factors	1
Minimum matching or adjustment for plausible prognostic variables; no adjustment	0
<b>VII. Attrition (missing data): If a concern was missing data handled appropriately</b>	
Yes	2
Not clear or not applicable	1
No	0
<b>VIII. Statistical methods adequate or appropriate and sufficiently described</b>	
Yes	2
Not clear or not applicable	1
No	0
<b>IX. Data presentation</b>	
Examples of data presented allows clear understanding of data analysis and interpretation	2
Examples provided but do not present a clear interpretation of data	1
Very little data presented or incomplete recording	0

## Additional file 3: Excluded studies with reasons for exclusion

Study Reference	Reason for Exclusion
Achat <i>et al</i> 2005 <sup>1</sup>	No results by residential location of women or for rural women
Andreeva & Pokhrel 2013 <sup>2</sup>	Does not assess one of the considered clinical questions
Ahern <i>et al</i> 2015 <sup>3</sup>	No results by residential location of women or for rural women
Azzopardi <i>et al</i> 2014 <sup>4</sup>	No results by residential location of women or for rural women
Banks <i>et al</i> 2014 <sup>5</sup>	No results specifically for female breast cancer patients
Banks <i>et al</i> 2010 <sup>6</sup>	No results specifically for female breast cancer patients
Barratt <i>et al</i> 1999 <sup>7</sup>	No results by residential location or for rural women in target screening age group
Beckmann <i>et al</i> 2011 <sup>8</sup>	Does not assess one of the considered clinical questions
Bell <i>et al</i> 2009 <sup>9</sup>	Does not assess one of the considered clinical questions
Bessen <i>et al</i> 2014 <sup>10</sup>	Does not assess one of the considered clinical questions
Bessen & Karnon 2014 <sup>11</sup>	Does not assess one of the considered clinical questions
Boyages <i>et al</i> 2010 <sup>12</sup>	Does not assess one of the considered clinical questions
Brennan & Spillane 2013 <sup>13</sup>	Review
Brennan & Houssami 2006 <sup>14</sup>	Does not assess one of the considered clinical questions
Brennan <i>et al</i> 2014 <sup>15</sup>	Review
Brennan <i>et al</i> 2011 <sup>16</sup>	Does not assess one of the considered clinical questions
Brennan <i>et al</i> 2011 <sup>17</sup>	Opinion piece
Brennan <i>et al</i> 2010 <sup>18</sup>	Survey of health professionals rather than women with breast cancer
Brennan <i>et al</i> 2010 <sup>19</sup>	Does not assess one of the considered clinical questions
Brown <i>et al</i> 2013 <sup>20</sup>	No results by residential location or for rural women in target screening age group
Buckley <i>et al</i> 2017 <sup>21</sup>	Does not assess one of the considered clinical questions
Buckley <i>et al</i> 2014 <sup>22</sup>	Does not assess one of the considered clinical questions
Budden <i>et al</i> 2007 <sup>23</sup>	Does not assess one of the considered clinical questions
Budden <i>et al</i> 2003 <sup>24</sup>	Does not assess one of the considered clinical questions
Butler-Henderson <i>et al</i> 2014 <sup>25</sup>	In situ and not invasive breast cancer
Canfell 2014 <sup>26</sup>	Review
Carrick <i>et al</i> 1998 <sup>27</sup>	Opinion piece
Chavez-Macgregor & Hortobagyi 2011 <sup>28</sup>	Opinion piece
Chin <i>et al</i> 2008 <sup>29</sup>	In situ and not invasive breast cancer
Chisholm <i>et al</i> 2000 <sup>30</sup>	Does not assess one of the considered clinical questions
Clarke 2002 <sup>31</sup>	Economic analysis; Does not assess one of the considered clinical questions
Clarke 1998 <sup>32</sup>	Economic analysis: Does not assess one of the considered clinical questions
Clover <i>et al</i> 1996 <sup>33</sup>	No results by residential location or for rural women in target screening age group
Cockburn <i>et al</i> 1997 <sup>34</sup>	No results by residential location or for rural women in target screening age group
Cockburn <i>et al</i> 1991 <sup>35</sup>	No results by residential location or for rural women in target screening age group
Coleman <i>et al</i> 2011 <sup>36</sup>	A comparative study across countries only
Coleman <i>et al</i> 2008 <sup>37</sup>	A comparative study across countries only
Craft <i>et al</i> 2010 <sup>38</sup>	No information by patient's residential location; only by treatment centre location
Cramb <i>et al</i> 2012 <sup>39</sup>	Does not assess one of the considered clinical questions
Cramb <i>et al</i> 2011 <sup>40</sup>	No results specifically for female breast cancer patients
Crombie <i>et al</i> 2005 <sup>41</sup>	No results by residential location of women or for rural women
Davey <i>et al</i> 2008 <sup>42</sup>	Does not assess one of the considered clinical questions
Delpizzo 1995 <sup>43</sup>	Does not assess one of the considered clinical questions
Dowling <i>et al</i> 2014 <sup>44</sup>	Does not assess one of the considered clinical questions
Emery <i>et al</i> 2013 <sup>45</sup>	No results specifically for female breast cancer patients
Emery 2010 <sup>46</sup>	Conference abstract
Fisher <i>et al</i> 2014 <sup>47</sup>	Not Australian-based
Fong <i>et al</i> 2012 <sup>48</sup>	A comparative study across countries only

Study Reference	Reason for Exclusion
1 Fong <i>et al</i> 2012 <sup>49</sup>	A comparative study across countries only
2 Frensham <i>et al</i> 2014 <sup>50</sup>	No results specifically for female breast cancer patients
3 Furnival 2004 <sup>51</sup>	Editorial
4 Furnival 1997 <sup>52</sup>	Editorial
5 Giles <i>et al</i> 2010 <sup>53</sup>	Methodological paper
6 Goldsbury <i>et al</i> 2012 <sup>54</sup>	Not breast cancer
7 Green <i>et al</i> 2013 <sup>55</sup>	Conference abstract
8 Halkett <i>et al</i> 2014 <sup>56</sup>	Study protocol
9 Halkett <i>et al</i> 2006 <sup>57</sup>	No results by residential location of women or for rural women
10 Harden <i>et al</i> 2014 <sup>58</sup>	Conference abstract
11 Harrison <i>et al</i> 2008 <sup>59</sup>	No results by residential location of women or for rural women
12 Hayes <i>et al</i> 2010 <sup>60</sup>	No results by residential location of women or for rural women
13 Heathcote & Armstrong 2007 <sup>61</sup>	Review
14 Hersch <i>et al</i> 2014 <sup>62</sup>	Study protocol
15 Heywood <i>et al</i> 1994 <sup>63</sup>	Does not assess one of the considered clinical questions
16 Hunt <i>et al</i> 2001 <sup>64</sup>	Does not assess one of the considered clinical questions
17 Hyndman & Holman 2000 <sup>65</sup>	Does not assess one of the considered clinical questions
18 Hyndman <i>et al</i> 1997 <sup>66</sup>	Does not assess one of the considered clinical questions
19 Ingram <i>et al</i> 2005 <sup>67</sup>	No information by patient's residential location; only by surgical caseload
20 Jones 2004 <sup>68</sup>	Opinion piece
21 Jong <i>et al</i> 2005 <sup>69</sup>	Opinion piece
22 Kavanagh <i>et al</i> 1999 <sup>70</sup>	Does not assess one of the considered clinical questions
23 Kiely <i>et al</i> 2013 <sup>71</sup>	Does not assess one of the considered clinical questions
24 Kiely <i>et al</i> 2010 <sup>72</sup>	Includes women with high breast cancer risk, no results by residential location
25 Kremser <i>et al</i> 2008 <sup>73</sup>	Does not assess one of the considered clinical questions
26 Kricker 1998 <sup>74</sup>	Review
27 Kricker <i>et al</i> 2009 <sup>75</sup>	No results by residential location of women or for rural women
28 Kricker <i>et al</i> 2008 <sup>76</sup>	Does not assess one of the considered clinical questions
29 Kwok & White 2011 <sup>77</sup>	Does not assess one of the considered clinical questions
30 Lawler <i>et al</i> 2012 <sup>78</sup>	Does not assess one of the considered clinical questions
31 Llewellyn <i>et al</i> 2011 <sup>79</sup>	Does not assess one of the considered clinical questions
32 Lobb <i>et al</i> 2002 <sup>80</sup>	Includes women with high breast cancer risk, no results by residential location
33 Lopez <i>et al</i> 2013 <sup>81</sup>	Not breast cancer
34 Lu <i>et al</i> 2013 <sup>82</sup>	Does not assess one of the considered clinical questions
35 Luke <i>et al</i> 2006 <sup>83</sup>	Does not assess one of the considered clinical questions
36 Luke <i>et al</i> 2003 <sup>84</sup>	No results specifically for female breast cancer patients
37 Magiros <i>et al</i> 2001 <sup>85</sup>	Does not assess one of the considered clinical questions
38 Marsh <i>et al</i> 2008 <sup>86</sup>	No information by patient's residential location; only by treatment centre location
39 Mauad <i>et al</i> 2009 <sup>87</sup>	Not Australian-based
40 McCredie <i>et al</i> 1995 <sup>88</sup>	Review
41 McMichael <i>et al</i> 2000 <sup>89</sup>	Does not assess one of the considered clinical questions
42 Moorin & Holman 2006 <sup>90</sup>	Does not assess one of the considered clinical questions
43 Moran & Warren-Forward 2011 <sup>91</sup>	Does not assess one of the considered clinical questions
44 Morley <i>et al</i> 2010 <sup>92</sup>	Only included women from urban areas
45 Morrell <i>et al</i> 2012 <sup>93</sup>	Does not assess one of the considered clinical questions
46 Ogunsiyi <i>et al</i> 2013 <sup>94</sup>	Does not assess one of the considered clinical questions
47 Paddison & Yip 2010 <sup>95</sup>	Not breast cancer
48 Page <i>et al</i> 2006 <sup>96</sup>	Does not assess one of the considered clinical questions
49 Peters 2012 <sup>97</sup>	Does not assess one of the considered clinical questions
50 Protani <i>et al</i> 2012 <sup>98</sup>	Does not assess one of the considered clinical questions

Study Reference	Reason for Exclusion
Richardson 2013 <sup>99</sup>	Opinion piece
Roder <i>et al</i> 2014 <sup>100</sup>	Does not assess one of the considered clinical questions
Roder <i>et al</i> 2011 <sup>101</sup>	Conference abstract
Rychetnik <i>et al</i> 2013 <sup>102</sup>	Editorial
Sandelin <i>et al</i> 2003 <sup>103</sup>	Does not assess one of the considered clinical questions
Sharma <i>et al</i> 2016 <sup>104</sup>	No results specifically for female breast cancer patients
Sharplin <i>et al</i> 2014 <sup>105</sup>	No results specifically for female breast cancer patients
Shugg <i>et al</i> 2002 <sup>106</sup>	Ductal carcinoma and not invasive breast cancer
Smith 2012 <sup>107</sup>	Review
Somogyi <i>et al</i> 2015 <sup>108</sup>	No information by patient's residential location; only by treatment centre location
Speedy & Hase 2000 <sup>109</sup>	Does not assess one of the considered clinical questions
Spillane <i>et al</i> 1999 <sup>110</sup>	No outcomes by patient's residential location; only by treatment centre location
Spillane <i>et al</i> 2001 <sup>111</sup>	No results by residential location of women or for rural women
Spilsbury <i>et al</i> 2005 <sup>112</sup>	Does not assess one of the considered clinical questions
Stanbury <i>et al</i> 2016 <sup>113</sup>	No results by residential location of women or for rural women
Stanton <i>et al</i> 1995 <sup>114</sup>	Does not assess one of the considered clinical questions
Sullivan <i>et al</i> 2004 <sup>115</sup>	Does not assess one of the considered clinical questions
Taylor <i>et al</i> 2003 <sup>116</sup>	No results by residential location of women or for rural women
Taylor <i>et al</i> 1999 <sup>117</sup>	Only included women from urban areas
Thewes <i>et al</i> 2003 <sup>118</sup>	Review
Thiruvarduchelvan <i>et al</i> 2010 <sup>119</sup>	Does not assess one of the considered clinical questions
Turnbull <i>et al</i> 1994 <sup>120</sup>	Does not assess one of the considered clinical questions
Villanueva <i>et al</i> 2008 <sup>121</sup>	No results by residential location of women or for rural women
Ward <i>et al</i> 2000 <sup>122</sup>	Does not assess one of the considered clinical questions
Weller 1998 <sup>123</sup>	Not breast cancer
Whitfield <i>et al</i> 2012 <sup>124</sup>	No information by patient's residential location; only by treatment centre location
Wilcoxon <i>et al</i> 2011 <sup>125</sup>	No results specifically for female breast cancer patients
Willis 2004 <sup>126</sup>	Looks at women outside the target age group for screening
Willis & Baxter 2003 <sup>127</sup>	Looks at women outside the target age group for screening
Winch <i>et al</i> 2015 <sup>128</sup>	Does not assess one of the considered clinical questions
Winefield <i>et al</i> 2004 <sup>129</sup>	Does not assess one of the considered clinical questions
Wong <i>et al</i> 2014 <sup>130</sup>	No results by residential location of women or for rural women
Woods <i>et al</i> 2010 <sup>131</sup>	A comparative study across countries only
Yelland <i>et al</i> 1991 <sup>132</sup>	No results by residential location of women or for rural women
Youl <i>et al</i> 2016 <sup>133</sup>	Does not assess one of the considered clinical questions
Youl <i>et al</i> 2011 <sup>134</sup>	Study protocol
Yu <i>et al</i> 2006 <sup>135</sup>	Does not assess one of the considered clinical questions
Zardawi <i>et al</i> 1999 <sup>136</sup>	Does not assess one of the considered clinical questions
Zilliacus <i>et al</i> 2010 <sup>137</sup>	Genetic counselling

References

1. Achat H, Close G, Taylor R. Who has regular mammograms? Effects of knowledge, beliefs, socioeconomic status, and health-related factors. *Prev Med* 2005;41(1):312-20.

2. Andreeva VA, Pokhrel P. Breast cancer screening utilization among Eastern European immigrant women worldwide: A systematic literature review and a focus on psychosocial barriers. *Psychooncology* 2013;22(12):2664-75.

3. Ahern T, Gardner A, Courtney M. A survey of the breast care nurse role in the provision of information and supportive care to Australian women diagnosed with breast cancer. *Nurs Open* 2015;2(2):62-71.

4. Azzopardi J, Walsh D, Chong C, et al. Surgical treatment for women with breast cancer in relation to socioeconomic and insurance status. *Breast J* 2014;20(1):3-8.

5. Banks P, Matheson LM, Morrissy K, et al. Characteristics of cancer diagnoses and staging in South Western Victoria: A rural perspective. *Aust J Rural Health* 2014;22(5):257-63.

6. Banks E, Byles JE, Gibson RE, et al. Is psychological distress in people living with cancer related to the fact of diagnosis, current treatment or level of disability? Findings from a large Australian study. *Med J Aust* 2010;193(5 Suppl):S62-68.

7. Barratt A, Cockburn J, Furnival C, et al. Perceived sensitivity of mammographic screening: women's views on test accuracy and financial compensation for missed cancers. *J Epidemiol Community Health* 1999;53(11):716-20.

8. Beckmann KR, Buckingham J, Craft P, et al. Clinical characteristics and outcomes of bilateral breast cancer in an Australian cohort. *Breast* 2011;20(2):158-64.

9. Bell RJ, Lijovic M, Fradkin P, et al. Lack of knowledge of hormone receptor status and use of endocrine therapy in invasive breast cancer. *Journal of Women's Health (15409996)* 2009;18(12):1975-80.

10. Bessen T, Chen G, Street J, et al. What sort of follow-up services would Australian breast cancer survivors prefer if we could no longer offer long-term specialist-based care? A discrete choice experiment. *Br J Cancer* 2014;110(4):859-67.

11. Bessen T, Karnon J. A patient-level calibration framework for evaluating surveillance strategies: A case study of mammographic follow-up after early breast cancer. *Asia Pac J Clin Oncol* 2014;10:95.

12. Boyages J, Jayasinghe UW, Coombs N. Multifocal breast cancer and survival: Each focus does matter particularly for larger tumours. *Eur J Cancer* 2010;46(11):1990-96.

13. Brennan ME, Spillane AJ. Uptake and predictors of post-mastectomy reconstruction in women with breast malignancy--systematic review. *Eur J Surg Oncol* 2013;39(6):527-41.

14. Brennan ME, Houssami N. Image-detected 'probably benign' breast lesions: A significant reason for referral from primary care. *Breast* 2006;15(5):683-86.

15. Brennan ME, Gormally JF, Butow P, et al. Survivorship care plans in cancer: a systematic review of care plan outcomes. *Br J Cancer* 2014;111(10):1899-908.

16. Brennan M, Butow P, Spillane AJ, et al. Follow up after breast cancer: Views of Australian women. *Aust Fam Physician* 2011;40(5):311-16.

17. Brennan ME, Butow P, Marven M, et al. Survivorship care after breast cancer treatment - Experiences and preferences of Australian women. *Breast* 2011;20(3):271-77.

18. Brennan ME, Butow P, Spillane AJ, et al. Survivorship care after breast cancer: follow-up practices of Australian health professionals and attitudes to a survivorship care plan. *Asia Pac J Clin Oncol* 2010;6(2):116-25.



19. Brennan ME, Butow P, Marvan M, et al. Survivorship care after breast cancer treatment - Experiences and preferences of Australian women. *Asia Pac J Clin Oncol* 2010;6:159.
20. Brown SL, Gibney TM, Tarling R. Busy lifestyles and mammography screening: time pressure and women's reattendance likelihood. *Psychol Health* 2013;28(8):928-38.
21. Buckley E, Farshid G, Gill G, et al. Assessing impact of organised breast screening across small residential areas-development and internal validation of a prediction model. *European Journal of Cancer Care* 2017;26(4):n/a-n/a.
22. Buckley E, Sullivan T, Farshid G, et al. Atypical hyperplasia as a risk factor for subsequent invasive or in situ breast cancer. *Eur J Cancer* 2014;50:S121.
23. Budden LM, Hayes BA, Pierce PF, et al. Australian women's prediagnostic values and influencing sociodemographic variables relating to treatment choices for early breast cancer treatment. *Australian Journal of Cancer Nursing* 2007;8(1):9-20.
24. Budden LM, Pierce PF, Hayes BA, et al. Australian women's prediagnostic decision-making styles, relating to treatment choices for early breast cancer treatment. *Res Theory Nurs Pract* 2003;17(2):117-36.
25. Butler-Henderson K, Lee AH, Lenzo NP, et al. Epidemiology of ductal carcinoma in situ in Western Australia: implications for surgical margins and management. *Breast Cancer* 2014.
26. Canfell K. Progress in cancer screening: Where are we in 2014? *Cancer Forum* 2014;38(3):191-96.
27. Carrick SE, Bonevski B, Redman S, et al. Surgeons' opinions about the NHMRC clinical practice guidelines for the management of early breast cancer. *Med J Aust* 1998;169(6):300-5.
28. Chavez-Macgregor M, Hortobagyi GN. Cancer survival in Australia, Canada, Denmark, Norway, Sweden, and the UK, 1995-2007 (the International Cancer Benchmarking Partnership): An analysis of population-based cancer registry data. *Breast Diseases* 2011;22(3):262-63.
29. Chin YS, Browne L, Graham PH. Breast conservation for ductal carcinoma in situ: Results at an Australian institution with evidence to recommend prospective assessment of the utility of a lumpectomy boost. *Asia Pac J Clin Oncol* 2008;4(3):137-42.
30. Chisholm J, Donoghue J, Dunn K, et al. A comparison of the awareness and utilisation of postoperative health services provided to women with breast cancer in public and private hospitals. *Aust Health Rev* 2000;23(2):113-22.
31. Clarke PM. Testing the convergent validity of the contingent valuation and travel cost methods in valuing the benefits of health care. *Health Econ* 2002;11(2):117-27.
32. Clarke PM. Cost-benefit analysis and mammographic screening: a travel cost approach. *J Health Econ* 1998;17(6):767-87.
33. Clover K, Redman S, Forbes J, et al. Two sequential randomized trials of community participation to recruit women for mammographic screening. *Prev Med* 1996;25(2):126-34.
34. Cockburn J, Schofield P, White V, et al. Predictors of returning for second round screening at a population based mammographic screening programme in Melbourne, Australia. *J Epidemiol Community Health* 1997;51(1):62-6.
35. Cockburn J, Hill D, Irwig L, et al. Development and validation of an instrument to measure satisfaction of participants at breast screening programmes. *Eur J Cancer* 1991;27(7):827-31.
36. Coleman MP, Forman D, Bryant H, et al. Cancer survival in Australia, Canada, Denmark, Norway, Sweden, and the UK, 1995-2007 (the International Cancer Benchmarking Partnership): an analysis of population-based cancer registry data. *Lancet* 2011;377(9760):127-38.
37. Coleman MP, Quaresma M, Berrino F, et al. Cancer survival in five continents: a worldwide population-based study (CONCORD). *The Lancet Oncology* 2008;9(8):730-56.

38. Craft PS, Buckingham JM, Dahlstrom JE, et al. Variation in the management of early breast cancer in rural and metropolitan centres: implications for the organisation of rural cancer services. *Breast* 2010;19(5):396-401.

39. Cramb SM, Garvey G, Valery PC, et al. The first year counts: Cancer survival among Indigenous and non-Indigenous Queenslanders, 1997-2006. *Medical Journal of Australia* 2012;196(4):270-74.

40. Cramb SM, Mengersen KL, Baade PD. Identification of area-level influences on regions of high cancer incidence in Queensland, Australia: a classification tree approach. *BMC Cancer* 2011;11:311.

41. Crombie K, Hancock K, Chang E, et al. Breast screening education at Australian and Thai worksites: a comparison of program effectiveness. *Contemporary Nurse: A Journal for the Australian Nursing Profession* 2005;19(1-2):181-96.

42. Davey HM, Barratt AL, Butow PN, et al. The impact of different criteria for selecting information to be provided to women undergoing diagnostic breast tests. *Patient Educ Couns* 2008;71(1):86-94.

43. Delpizzo V. Imprecise exposure assessment and the sample size requirements of case-control studies of residential magnetic field exposure and cancer in adults. *Bioelectromagnetics* 1995;16(2):132-42.

44. Dowling A, Henderson M, Saunders C, et al. Circulating tumour cells in early stage breast cancer the empathy breast cancer network. *Asia Pac J Clin Oncol* 2014;10:175.

45. Emery JD, Walter FM, Gray V, et al. Diagnosing cancer in the bush: a mixed methods study of GP and specialist diagnostic intervals in rural Western Australia. *Fam Pract* 2013;30(5):541-50.

46. Emery J. The potential role of primary care in cancer survivorship. *Asia Pac J Clin Oncol* 2010;6:38.

47. Fisher A, Juraskova I, Butow P, et al. not just following what doctors say: Piloting of a decision aid for women considering participation in the sentinel node biopsy versus axillary clearance 2 (SNAC2) trial. *Asia Pac J Clin Oncol* 2014;10:107.

48. Fong A, Shafiq J, Saunders C, et al. A comparison of systemic breast cancer therapy utilization in Canada (British Columbia), Scotland (Dundee), and Australia (Western Australia) with models of "optimal" therapy. *Breast* 2012;21(4):562-69.

49. Fong A, Shafiq J, Saunders C, et al. A comparison of surgical and radiotherapy breast cancer therapy utilization in Canada (British Columbia), Scotland (Dundee), and Australia (Western Australia) with models of "optimal" therapy. *Breast* 2012;21(4):570-7.

50. Frensham LJ, Zarnowiecki DM, Parfitt G, et al. The experiences of participants in an innovative online resource designed to increase regular walking among rural cancer survivors: a qualitative pilot feasibility study. *Support Care Cancer* 2014;22(7):1923-29.

51. Furnival C. Access to breast-conserving treatment: are surgeons responsible? *ANZ J Surg* 2004;74(6):402-3.

52. Furnival CM. Breast cancer in rural Australia. *Med J Aust* 1997;166(1):25-6.

53. Giles C, Marr G, Zorbas H. Shared follow-up care for early breast cancer - A new model of care. *Asia Pac J Clin Oncol* 2010;6:112.

54. Goldsbury DE, Armstrong K, Simonella L, et al. Using administrative health data to describe colorectal and lung cancer care in New South Wales, Australia: a validation study. *BMC Health Serv Res* 2012;12:387.

55. Green T, Zarate D, Colquist S, et al. Patterns of mastectomy for invasive breast cancer in Queensland. *Asia Pac J Clin Oncol* 2013;9:88.

56. Halkett G, O'Connor M, Aranda S, et al. Protocol for the RT Prepare Trial: A multiple-baseline study of radiation therapists delivering education and support to women with breast cancer who are referred for radiotherapy. *BMJ Open* 2014;4(8).



57. Halkett G, Arbon P, Scutter S, et al. The role of the breast care nurse during treatment for early breast cancer: the patient's perspective. *Contemporary Nurse: A Journal for the Australian Nursing Profession* 2006;23(1):46-57.
58. Harden H, Colquist S, Walpole E, et al. Queensland cancer quality index: Tracking queensland's progress in improving cancer care. *Asia Pac J Clin Oncol* 2014;10:147.
59. Harrison JD, Choy ET, Spillane A, et al. Australian breast cancer specialists' involvement in multidisciplinary treatment planning meetings. *Breast* 2008;17(4):335-40.
60. Hayes SC, Rye S, Battistutta D, et al. Upper-body morbidity following breast cancer treatment is common, may persist longer-term and adversely influences quality of life. *Health Qual Life Outcomes* 2010;8:92.
61. Heathcote K, Armstrong B. Disparities in cancer outcomes in regional and rural Australia. *Cancer Forum* 2007;31(2):70-4.
62. Hersch J, Barratt A, Jansen J, et al. The effect of information about overdetection of breast cancer on women's decision-making about mammography screening: Study protocol for a randomised controlled trial. *BMJ Open* 2014;4(5).
63. Heywood A, Sanson-Fisher R, Ring I, et al. Risk prevalence and screening for cancer by general practitioners. *Prev Med* 1994;23(2):152-9.
64. Hunt RW, Fazekas BS, Luke CG, et al. Where patients with cancer die in South Australia, 1990-1999: A population-based review. *Med J Aust* 2001;175(10):526-29.
65. Hyndman JC, Holman CD. Differential effects on socioeconomic groups of modelling the location of mammography screening clinics using Geographic Information Systems. *Aust N Z J Public Health* 2000;24(3):281-6.
66. Hyndman J, Holman CD, Jamrozik K. The effect of spatial definition on the allocation of clients to screening clinics. *Soc Sci Med* 1997;45(2):331-40.
67. Ingram DM, McEvoy SP, Byrne MJ, et al. Surgical caseload and outcomes for women with invasive breast cancer treated in Western Australia. *Breast* 2005;14(1):11-7.
68. Jones SC. Coverage of breast cancer in the Australian print media--does advertising and editorial coverage reflect correct social marketing messages? *J Health Commun* 2004;9(4):309-25.
69. Jong KE, Vale PJ, Armstrong BK. Rural inequalities in cancer care and outcome. *Med J Aust* 2005;182(1):13-14.
70. Kavanagh AM, Mitchell H, Farrugia H, et al. Monitoring interval cancers in an Australian mammographic screening programme. *J Med Screen* 1999;6(3):139-43.
71. Kiely BE, McCaughan G, Christodoulou S, et al. Using scenarios to explain life expectancy in advanced cancer: attitudes of people with a cancer experience. *Support Care Cancer* 2013;21(2):369-76.
72. Kiely BE, Jenkins MA, McKinley JM, et al. Contralateral risk-reducing mastectomy in BRCA1 and BRCA2 mutation carriers and other high-risk women in the Kathleen Cuninghame Foundation Consortium for Research into Familial Breast Cancer (kConFab). *Breast Cancer Res Treat* 2010;120(3):715-23.
73. Kremser T, Evans A, Moore A, et al. Use of complementary therapies by Australian women with breast cancer. *Breast* 2008;17(4):387-94.
74. Kricker A. Issues in breast cancer screening in Australia. *Cancer Forum* 1998;22(1):11-15.
75. Kricker A, Price M, Butow P, et al. Effects of life event stress and social support on the odds of a  $\geq 2$  cm breast cancer. *Cancer Causes Control* 2009;20(4):437-47.
76. Kricker A, Newman B, Gertig DM, et al. Why do large breast cancers still present in a population offered screening? *Int J Cancer* 2008;123(12):2907-14.

77. Kwok C, White K. Cultural and linguistic isolation: The breast cancer experience of Chinese-Australian women--A qualitative study. *Contemporary Nurse: A Journal for the Australian Nursing Profession* 2011;39(1):85-94.

78. Lawler S, Spathonis K, Masters J, et al. Transition to follow-up care after breast cancer treatment in rural australia: Women's experiences of service provision. *Asia Pac J Clin Oncol* 2012;8:240.

79. Llewellyn G, Balandin S, Poulos A, et al. Disability and mammography screening: intangible barriers to participation. *Disabil Rehabil* 2011;33(19-20):1755-67.

80. Lobb EA, Butow PN, Meiser B, et al. Tailoring communication in consultations with women from high risk breast cancer families. *Br J Cancer* 2002;87(5):502-8.

81. Lopez PJT, Albero JS, Rodriguez-Montes JA. Is it possible to reduce the incident of colorectal cancer by modifying diet and lifestyle? *Curr Cancer Ther Rev* 2013;9(3):157-63.

82. Lu CY, Srasuebkul P, Drew AK, et al. Trastuzumab therapy in Australia: which patients with HER2+ metastatic breast cancer are assessed for cardiac function? *Breast* 2013;22(4):482-7.

83. Luke C, Priest K, Roder D. Changes in incidence of in situ and invasive breast cancer by histology type following mammography screening. *Asian Pac J Cancer Prev* 2006;7(1):69-74.

84. Luke C, Chapman P, Priest K, et al. Use of radiotherapy in the primary treatment of cancer in South Australia. *Australas Radiol* 2003;47(2):161-7.

85. Magiros M, Norgrove JM, Arvin MP, et al. Women's access to resources about early breast cancer. *Med J Aust* 2001;174(12):664-5.

86. Marsh CJ, Boulton M, Wang JX, et al. National Breast Cancer Audit: the use of multidisciplinary care teams by breast surgeons in Australia and New Zealand. *Med J Aust* 2008;188(7):385-8.

87. Mauad EC, Nicolau SM, Moreira LF, et al. Adherence to cervical and breast cancer programs is crucial to improving screening performance. *Rural Remote Health* 2009;9(3):1241.

88. McCredie M, Hopper JL, Cawson JN. Risk factors and preventive strategies for breast cancer. *Med J Aust* 1995;163(8):435-37,39-40.

89. McMichael C, Kirk M, Manderson L, et al. Indigenous women's perceptions of breast cancer diagnosis and treatment in Queensland. *Aust N Z J Public Health* 2000;24(5):515-19.

90. Moorin RE, Holman CD. The effects of socioeconomic status, accessibility to services and patient type on hospital use in Western Australia: a retrospective cohort study of patients with homogenous health status. *BMC Health Serv Res* 2006;6:74.

91. Moran S, Warren-Forward H. A retrospective study of the performance of radiographers in interpreting screening mammograms. *Radiography* 2011;17(2):126-31.

92. Morley KI, Milne RL, Giles GG, et al. Socio-economic status and survival from breast cancer for young, Australian, urban women. *Aust N Z J Public Health* 2010;34(2):200-5.

93. Morrell S, Taylor R, Roder D, et al. Mammography screening and breast cancer mortality in Australia: an aggregate cohort study. *J Med Screen* 2012;19(1):26-34.

94. Ogunsiyi O, Wilkes L, Peters K, et al. Knowledge, attitudes and usage of cancer screening among West African migrant women. *J Clin Nurs* 2013;22(7/8):1026-33.

95. Paddison JS, Yip MJ. Exploratory study examining barriers to participation in colorectal cancer screening. *Aust J Rural Health* 2010;18(1):11-5.

96. Page A, Morrell S, Chiu C, et al. Recruitment to mammography screening: A randomised trial and meta-analysis of invitation letters and telephone calls. *Aust N Z J Public Health* 2006;30(2):111-18.

97. Peters K. Politics and patriarchy: Barriers to health screening for socially disadvantaged women. *Contemporary Nurse: A Journal for the Australian Nursing Profession* 2012;42(2):190-97.

98. Protani M, Page A, Taylor R, et al. Breast cancer risk factors in Queensland women attending population-based mammography screening. *Maturitas* 2012;71(3):279-86.
99. Richardson G. Challenges of treating patients with cancer in Australia. *Ann Oncol* 2013;24:ix9.
100. Roder DM, Ward GH, Farshid G, et al. Influence of service characteristics on high priority performance indicators and standards in the BreastScreen Australia program. *Asian Pac J Cancer Prev* 2014;15(14):5901-8.
101. Roder D, De Silva P, Kollias J, et al. A study of the predictors of survival from breast cancers managed by Australian surgeons participating in the national breast cancer audit of the royal Australasian college of surgeons. *Asia Pac J Clin Oncol* 2011;7:169-70.
102. Rychetnik L, Carter SM, Abelson J, et al. Enhancing citizen engagement in cancer screening through deliberative democracy. *JNCI: Journal of the National Cancer Institute* 2013;105(6):380-86.
103. Sandelin K, King E, Redman S. Breast reconstruction following mastectomy: current status in Australia. *ANZ J Surg* 2003;73(9):701-6.
104. Sharma DK, Vangaveti VN, Larkins S. Geographical access to radiation therapy in North Queensland: a retrospective analysis of patient travel to radiation therapy before and after the opening of an additional radiotherapy facility. *Rural Remote Health* 2016;16(1):3640.
105. Sharplin G, Bannister S, Eckert M, et al. A South Australian cancer atlas shows important variations in cancer risk and outcomes, but can better use be made of Australian data to support the work of cancer councils? *Cancer Forum* 2014;38(2):143-49.
106. Shugg D, White VM, Kitchen PR, et al. Surgical management of ductal carcinoma in situ in Australia in 1995. *ANZ J Surg* 2002;72(10):708-15.
107. Smith T. A long way from home: Access to cancer care for rural Australians. *Radiography* 2012;18(1):38-42.
108. Somogyi RB, Webb A, Baghdikian N, et al. Understanding the factors that influence breast reconstruction decision making in Australian women. *Breast* 2015;24(2):124-30.
109. Speedy S, Hase S. Health beliefs and perceptions of women presenting or not presenting for mammographic screening in a rural health setting. *Aust J Rural Health* 2000;8(4):208-13.
110. Spillane AJ, Littlejohn D, Wong S, et al. Australia's breast surgery workload is changing: comparison of a metropolitan and a rural hospital. *Aust N Z J Surg* 1999;69(3):178-82.
111. Spillane AJ, Kennedy CW, Gillett DJ, et al. Screen-detected breast cancer compared to symptomatic presentation: an analysis of surgical treatment and end-points of effective mammographic screening. *ANZ J Surg* 2001;71(7):398-402.
112. Spilsbury K, Semmens JB, Saunders CM, et al. Subsequent surgery after initial breast conserving surgery: a population based study. *ANZ J Surg* 2005;75(5):260-4.
113. Stanbury JF, Baade PD, Yu Y, et al. Cancer survival in New South Wales, Australia: socioeconomic disparities remain despite overall improvements. *BMC Cancer* 2016;16(1):48.
114. Stanton WR, Fisher KJ, Balanda KP, et al. Patient reports of health education activities in a public hospital. *Aust Health Rev* 1995;18(2):85-100.
115. Sullivan SG, Slack-Smith LM, Hussain R. Understanding the use of breast cancer screening services by women with intellectual disabilities. *Soz Präventivmed* 2004;49(6):398-405.
116. Taylor R, Davis P, Boyages J. Long-term survival of women with breast cancer in New South Wales. *Eur J Cancer* 2003;39(2):215-22.
117. Taylor R, Stubbs JM, Langlands AO, et al. Predictors of mastectomy for women with breast cancer in the greater western region of sydney. *Breast Journal* 1999;5(2):116-21.

118. Thewes B, Meiser B, Tucker K, et al. Screening for psychological distress and vulnerability factors in women at increased risk for breast cancer: a review of the literature. *Psychol Health Med* 2003;8(3):289-304.

119. Thiruvurudchelvan A, Hamilton A, Fenton G, et al. 5 year outcomes of the breast and ovarian cancer risk management clinic at the Royal Prince Alfred hospital. *Asia Pac J Clin Oncol* 2010;6:227.

120. Turnbull D, Irwig L, Simpson JM, et al. The psychosocial impact of implementing a mammography screening campaign in an Australian community. *Soc Sci Med* 1994;39(4):543-51.

121. Villanueva EV, Jones S, Nehill C, et al. The 2003 Australian Breast Health Survey: survey design and preliminary results. *BMC Public Health* 2008;8:13.

122. Ward J, Rikard-Bell G, Hobbs M. Improving local services for women with breast cancer: interviews with general practitioners in central Sydney. *Aust Health Rev* 2000;23(2):123-33.

123. Weller D. Colorectal cancer screening in Australia - Where to now? *Cancer Forum* 1998;22(1):15-18.

124. Whitfield R, Kollias J, De Silva P, et al. Use of trastuzumab in Australia and New Zealand: results from the National Breast Cancer Audit. *ANZ J Surg* 2012;82(4):234-39.

125. Wilcoxon H, Luxford K, Saunders C, et al. Multidisciplinary cancer care in Australia: A national audit highlights gaps in care and medico-legal risk for clinicians. *Asia Pac J Clin Oncol* 2011;7(1):34-40.

126. Willis K. Personal choice/social responsibility: women aged 40-49 years and mammography screening. *Journal of Sociology* 2004;40(2):121-36.

127. Willis K, Baxter J. Trusting technology: women aged 40-49 years participating in screening for breast cancer--an exploratory study. *Aust N Z J Public Health* 2003;27(3):282-6.

128. Winch CJ, Sherman KA, Boyages J. Toward the breast screening balance sheet: cumulative risk of false positives for annual versus biennial mammograms commencing at age 40 or 50. *Breast Cancer Res Treat* 2015;149(1):211-21.

129. Winefield HR, Coventry BJ, Lambert V. Setting up a health education website: Practical advice for health professionals. *Patient Educ Couns* 2004;53(2):175-82.

130. Wong A, Snook K, Brennan M, et al. Increasing breast reconstruction rates by offering more women a choice. *ANZ J Surg* 2014;84(1-2):31-36.

131. Woods LM, Rachet B, O'Connell DL, et al. Differences in breast cancer incidence in Australia and England by age, extent of disease and deprivation status: women diagnosed 1980-2002. *Aust N Z J Public Health* 2010;34(2):206-13.

132. Yelland MJ, Rice DE, Ward AE, et al. A profile of Australian women practicing breast self-examination. *Asia Pac J Public Health* 1991;5(4):307-12.

133. Youl PH, Aitken JF, Turrell G, et al. The Impact of Rurality and Disadvantage on the Diagnostic Interval for Breast Cancer in a Large Population-Based Study of 3202 Women in Queensland, Australia. *Int J Environ Res Public Health* 2016;13(11).

134. Youl PH, Baade PD, Aitken JF, et al. A multilevel investigation of inequalities in clinical and psychosocial outcomes for women after breast cancer. *BMC Cancer* 2011;11.

135. Yu XQ, O'Connell DL, Gibberd RW, et al. Trends in survival and excess risk of death after diagnosis of cancer in 1980-1996 in New South Wales, Australia. *Int J Cancer* 2006;119(4):894-900.

136. Zardawi IM, Hearnden F, Meyer P, et al. Ultrasound-guided fine needle aspiration cytology of impalpable breast lesions in a rural setting. Comparison of cytology with imaging and final outcome. *Acta Cytol* 1999;43(2):163-8.

137. Zilliacus E, Meiser B, Lobb E, et al. The virtual consultation: practitioners' experiences of genetic counseling by videoconferencing in Australia. *Telemed J E Health* 2010;16(3):350-7.

# Additional file 4 Detailed characteristics of the included studies by three key themes.

**Table 1.** Detailed characteristics of included studies on survival outcomes by residential location

Study	Location <sup>1</sup>	Design	Source	Period (follow-up)	Sample <sup>2</sup>	Outcomes	Analysis	Key findings
AIHW 2013 <sup>1</sup>	National	Cohort	ACD	1982-2007 (end 2010)	NS	5-year relative survival	Relative survival	Poorer survival for non-metropolitan women (84% versus 90% metropolitan). No adjusted estimates.
Bonnet <i>et al</i> 1990 <sup>2</sup>	SA	Cohort	SA CR	1980-1986 (end 1988)	2,565	5-year relative survival	Proportional hazards regression	Poorer unadjusted (74% versus 76-78% metropolitan) and adjusted <sup>3</sup> survival (2-9 times higher mortality risk) for non-metropolitan women.
Chen <i>et al</i> 2015 <sup>3</sup>	NSW	Cohort	NSW CCR	2000-2008	36,867	5-year BC survival	Kaplan-Meier, Cox regression	Poorer survival for outer regional women with regional (82% versus 86% metropolitan) and distant (33% versus 44%) disease. Also poorer adjusted <sup>4</sup> survival (regional: 22%; distant: 30% higher BC mortality).
Clayforth <i>et al</i> 2007 <sup>4</sup>	WA	Cohort	WA CR	1989, 1994, 1999 (end 2005)	1,729	5-year overall survival	Kaplan-Meier, Cox regression	Poorer survival for non-metropolitan women (79% versus 85% metropolitan). Metropolitan women had better adjusted <sup>5</sup> survival (30% lower mortality).
Cramb <i>et al</i> 2012 <sup>5</sup>	Qld	Cohort	Qld CR	1996-2007	25,202	5-year relative survival	Bayesian spatial regression	Poorer survival for women living >6 hours from a radiation facility (83% versus 86% living <2 hours). No difference after adjustment. <sup>6</sup>
Cramb <i>et al</i> 2016a <sup>6</sup>	Qld	Cohort	Qld CR	1997-2011	NS	5-year relative survival	Bayesian spatial regression	Poorer survival for non-metropolitan women after adjustment. <sup>7</sup>
Cramb <i>et al</i> 2016b <sup>7</sup>	Qld	Cohort	Qld CR	1997-2011	34,231	5-year relative survival	Bayesian spatial regression	Poorer survival for non-metropolitan women after adjustment. <sup>7</sup>
Cramb <i>et al</i> 2017 <sup>8</sup>	Qld	Cohort	Qld CR	1997-2004 (end 2005); 2005-2012 (end 2013)	38,204, aged 15-89 years	5-year relative survival	Bayesian spatial regression	Poorer age-adjusted survival for non-metropolitan women.
Dasgupta <i>et al</i> 2012 <sup>9</sup>	Qld	Cohort	Qld CR	1997-2006 (end 2007)	18,568, first primary, aged 30-79 years	5-year BC survival	Kaplan-Meier, Multilevel regression	Poorer survival for non-metropolitan women (88% versus 91% metropolitan). No difference after adjustment. <sup>8</sup>
Hall <i>et al</i> 2004a <sup>10</sup>	WA	Cohort	WA Record Linkage Project	1991-2001	7,117, BC-surgery	5-year overall survival	Chi-square, Cox regression	Poorer survival for non-metropolitan women (78% versus 83% metropolitan). No difference after adjustment. <sup>9</sup>
Hsieh <i>et al</i> 2014 <sup>11</sup>	Qld	Cohort	Qld CR, BS Qld	1997-2007 (end 2008)	23,766, aged <90 years	5-year relative survival	Bayesian spatial regression	Poorer unadjusted and adjusted survival for non-metropolitan women (relative excess risk of death 1.1-1.4). <sup>10</sup>
Hsieh <i>et al</i> 2016a <sup>12</sup>	Qld	Cohort	Qld CR, BS Qld	1997-2007 (end 2008)	23,766, aged <90 years	5-year relative survival	Bayesian spatial regression	Poorer survival for non-metropolitan women after adjustment. <sup>11</sup>
Hsieh <i>et al</i> 2016b <sup>13</sup>	Qld	Cohort	Qld CR, BS Qld	1997-2007 (end 2008)	9,741, aged 40-89 years, screened	5-year relative survival	Bayesian spatial regression	No difference in unadjusted and adjusted survival. <sup>10</sup>
Mitchell <i>et al</i> 2006 <sup>14</sup>	WA	Cohort	WA CR	1999 (end 2004)	899, first primary	5-year overall survival	Kaplan-Meier, Cox regression	Poorer survival for non-metropolitan women (78% versus 87% metropolitan). No difference after adjustment. <sup>12</sup>



Study	Location <sup>1</sup>	Design	Source	Period (follow-up)	Sample <sup>2</sup>	Outcomes	Analysis	Key findings
Roder <i>et al</i> 2012a <sup>15</sup>	National	Cohort	National BS, CR's, record linkage	1991-2006	62,082, screened	5-year overall & BC survival	Cox regression	Poorer survival for regional non-Indigenous (88-89% versus 90% metropolitan) and Indigenous women (75-79% versus 86%). No difference after adjustment. <sup>13</sup>
Spilsbury <i>et al</i> 2005 <sup>16</sup>	WA	Cohort	WA Record Linkage Project	1982-2000	11,445, BC-surgery	5-year relative & BC survival	Relative survival, Cox regression	Poorer survival for non-metropolitan women (82% versus 86% metropolitan). No difference after adjustment. <sup>14</sup>
Supramaniam <i>et al</i> 2014 <sup>17</sup>	NSW	Cohort	NSW CCR, NSW APDC, record linkage	2001-2007 (end 2008)	27,850, aged ≥18 years	5-year BC survival	Cox regression	Non-metropolitan women had (unadjusted) 11%-20% poorer survival than metropolitan women. No difference after adjustment. <sup>15</sup>
Taylor 1997 <sup>18</sup>	NSW	Cohort	NSW CCR	1980-1991 (end 1992)	25,793	5-year relative survival	Relative survival models	No differences in either unadjusted or adjusted <sup>16</sup> survival estimates.
Tervonen <i>et al</i> 2017 <sup>19</sup>	NSW	Cohort	NSW CCR	1980-2008 (end 2009)	88,768	5-year BC survival	Competing risk	Poorer unadjusted survival for non-metropolitan women. No difference after adjustment. <sup>17</sup>
Tracey <i>et al</i> 2008 <sup>20</sup>	NSW	Cohort	NSW CCR	1980-2003 (end 2004)	59,731, known spread of disease	Case fatality: 5 and 10 years post-diagnosis	Kaplan-Meier, Cox regression	Poorer survival for non-metropolitan women. No difference after adjustment. <sup>17</sup>
Yu <i>et al</i> 2015 <sup>21</sup>	NSW	Cohort	NSW CCR	1987-2007 (end 2007)	63,757, aged 18-84 years	5-year relative survival	Relative survival models	Poorer survival for non-metropolitan women. Also 25% poorer adjusted <sup>18</sup> survival from 1997 onwards (non-localised disease only).
Wilkinson & Cameron 2004 <sup>22</sup>	SA	Cohort	SA CR	1977-1993 (to 2000)	NS	5-year BC survival	Survival percentages	Poorer survival for non-metropolitan women (73% versus 77% metropolitan). No adjusted estimates

ACD Australian Cancer Database, APDC Department of Health Admitted Patient Data Collection, BC Breast Cancer, BS BreastScreen, CR Cancer Registry, CCR Central Cancer Registry, NS not stated

1. National: all states/territories; NSW: New South Wales; Qld: Queensland; SA: South Australia and WA Western Australia
2. Female invasive breast cancers cases
3. Adjusted for tumour size and nodal status.
4. Adjusted for age at diagnosis and stratified by spread of disease (classified as localised, regional or distant).
5. Adjusted for age and year at diagnosis, spread of disease, surgical caseload and treatment-related factors.
6. Adjusted for age at diagnosis, spread of disease, distance to treatment and area-disadvantage.
7. Adjusted for age at diagnosis and spread of disease.
8. Adjusted for age at diagnosis, spread of disease, Indigenous status, demographics, and area-disadvantage.
9. Adjusted for age and year at diagnosis, Indigenous status, demographics, comorbidities, area-disadvantage, hospital characteristics and surgical status.
10. Adjusted for age at diagnosis, spread of disease, Indigenous status, demographics, detection methods and area-disadvantage
11. Adjusted for age at diagnosis, spread of disease, Indigenous status, demographics and screening status.
12. Adjusted for age at diagnosis, spread of disease, surgical caseload and treatment-related factors.
13. Adjusted for age at diagnosis, diagnostic period, Indigenous status and area-disadvantage.
14. Adjusted for age at diagnosis, diagnostic period, Indigenous status, comorbidities, area-disadvantage, hospital type and treatment-related factors.
15. Adjusted for age and year at diagnosis, spread of disease, Indigenous status, comorbidities, area-disadvantage and surgical status.
16. Adjusted for age at diagnosis, spread of disease, follow-up interval and interactions between these variables.
17. Adjusted for age at diagnosis, diagnostic period, spread of disease, area-disadvantage and country of birth.
18. Adjusted for age at diagnosis, diagnostic period and area-disadvantage; stratified by spread of disease (classified as localised or non-localised).

**Table 2.** Characteristics of included studies on patient and tumour characteristics by residential location

Study	Location <sup>1</sup>	Design	Source	Period	Sample <sup>2</sup>	Outcomes	Analysis	Key findings
Roder <i>et al</i> 2013a <sup>23</sup>	National	Non-representative sample	NBCA database <sup>3</sup>	1998-2010	30,299, early disease <sup>4</sup>	Predictors of increasing residential remoteness	Chi-square, Logistic regression	Disadvantaged women (versus affluent) more likely to live in inner regional (10 times), outer regional (33 times) or remote (17 times) areas than metropolitan areas. Residential disadvantage a key predictor of increasing remoteness. <sup>5</sup>
Roder <i>et al</i> 2014 <sup>24</sup>	National	Non-representative sample	NBCA database <sup>3</sup>	1998-2010	30,299, early disease <sup>4</sup>	Predictors of lower residential disadvantage	Chi-square, Logistic regression	Inner regional (5 times, versus metropolitan), outer regional (10 times) and remote women (13 times) more likely to live in disadvantaged than affluent regions. <sup>6</sup>
Baade <i>et al</i> 2011 <sup>25</sup>	Qld	Cohort	Qld CR	1997-2006	18,568, aged 30-79 years, known tumour size and nodal status (if $\leq 20$ mm)	Stage <sup>7</sup>	Multilevel logistic regression	Outer regional women (versus metropolitan) 13% more likely to have advanced disease. <sup>8</sup>
Bonnet <i>et al</i> 1990 <sup>2</sup>	SA	Cohort	SA CR	1980-1986	1,171, known tumour size and nodal status	Tumour size, nodal status	Chi-square	No differences in tumour size or nodal status.
Dasgupta <i>et al</i> 2017a <sup>26</sup>	Qld	Cohort	Qld CR	1997-2014	38,706, aged at least 30 years, known tumour size and nodal status	Stage <sup>7</sup>	Multilevel logistic regression	Women from less accessible areas (versus highly accessible) 18% more likely to have advanced disease. <sup>9</sup> Trend analysis showed only limited evidence for reduction in disparity over time.
Depczynski, <i>et al</i> 2017 <sup>27</sup>	NSW	Record linkage	45 and Up study, NSW CR	2006-2009	726, aged at least 45 years, known spread of disease	Degree of spread <sup>10</sup>	Chi-square, Logistic regression	No differences in degree of spread. <sup>11</sup>
Fox <i>et al</i> 2013 <sup>28</sup>	NSW	Medical chart reviews	4 medical centres	2008-2011	400, Stage I-III, had adjuvant CT	Median tumour size	Mann-Whitney	No differences in tumour size.
Kok <i>et al</i> 2006 <sup>29</sup>	Vic	Retrospective cohort	BS Vic	1993-2000	5,294, screen-detected	Tumour size, nodal status	Chi-square	Non-metropolitan women (versus metropolitan) had larger tumours; no difference in nodal status.
Leung <i>et al</i> 2016 <sup>30</sup>	NSW, Qld, Vic	Record linkage	ALSWH NSW Vic & QLD CR's	1997-2011	195, aged 50-55 years, known spread of disease,	Stage <sup>7</sup>	Logistic regression	No difference in stage. <sup>12</sup>
Luke <i>et al</i> 2004 <sup>31</sup>	SA	Cohort	SA CR	1997-2002	4,912, known tumour size	Tumour size	Mann-Whitney	No difference in tumour size
Lord <i>et al</i> 2012 <sup>32</sup>	NSW	Cohort	NSW CR	2001-2002	6,664, non-metastatic, known spread of disease	Degree of spread <sup>13</sup>	Chi-square	No difference in degree of spread
Mitchell <i>et al</i> 2006 <sup>14</sup>	WA	Cohort	WA CR	1999	899, first primary, histologically verified	Tumour size, grade, vascular invasion, nodal status	Chi-square	No differences in tumour size or other characteristics
Roder <i>et al</i> 2013b <sup>33</sup>	National	Non-representative sample	NBCA database <sup>3</sup>	1998-2010	30,299, early disease <sup>4</sup>	Tumour size, grade, nodal status, receptor status	Chi-square	Non-metropolitan women (versus metropolitan) 15% more likely to have larger tumours. No differences in other characteristics.



Study	Location <sup>1</sup>	Design	Source	Period	Sample <sup>2</sup>	Outcomes	Analysis	Key findings
Tracey <i>et al</i> 2008 <sup>20</sup>	NSW	Cohort	NSW CCR	1980-2003	59,731, known spread of disease	Degree of spread <sup>13</sup>	Logistic regression	Metropolitan women 11% more likely to have regional disease than non-metropolitan women. <sup>14</sup> No difference for distant disease
Wilkinson & Cameron 2004 <sup>22</sup>	SA	Cohort	SA CR	1980-1998	NS	Proportion of tumours >20mm	Chi-square	No difference in tumour size

ALSWH Australian Longitudinal Study on Women’s Health, BS BreastScreen, CR Cancer Registry, CCR Central Cancer Registry CT Chemotherapy, NBCA National Breast Cancer Audit Database, NS not stated

1. National: all states/territories; NSW: New South Wales; Qld: Queensland; SA: South Australia; Vic: Victoria and WA Western Australia
2. Female invasive breast cancers cases
3. National Breast Cancer Audit Database covers about 60% of early (note 4) invasive female breast cancers diagnosed in Australia between 1998 and 2010.
4. Early disease defined as invasive tumours of ≤50mm size with either impalpable or palpable but not fixed lymph nodes and no evidence for distant metastases.
5. Adjusted for age at diagnosis, diagnostic period, area disadvantage, surgical caseload, hospital location and treatment-related factors.
6. Adjusted for diagnostic period, referral source, tumour laterality, ovarian ablation and hospital location.
7. Classified as early (≤20mm size, no evidence of nodal involvement) or advanced/late (>20mm size and/or positive nodal status, includes cases diagnosed due to metastatic disease)
8. Adjusted for age at diagnosis, diagnostic period, Indigenous status, demographics and area-disadvantage.
9. Adjusted for age and year at diagnosis, Indigenous status, clinical features, demographics and area-disadvantage.
10. Classified as localised (node-negative) or non-localised (regional or distant).
11. Adjusted for age at diagnosis, family history of cancer and demographics.
12. Adjusted for year of diagnosis and birth, demographics, menopausal status, hormone replacement therapy and area-disadvantage
13. Classified as localised (node-negative), regional (involves regional lymph nodes or adjacent tissues, includes locally advanced disease) or distant (metastatic disease).
14. Adjusted for age at diagnosis, diagnostic period, area-disadvantage and country of birth.

**Table 3.** Characteristics of included studies on diagnostic outcomes

Study	Location <sup>1</sup>	Design	Source	Period	Sample	Outcomes	Analysis	Key findings
Barratt <i>et al</i> 1997 <sup>34</sup>	National	Cross-sectional	Telephone directory	1996	1,035, aged 50-69 years, no breast cancer history	Self-reported screening history	Chi-square	No differences in screening rates.
Cockburn <i>et al</i> 1997 <sup>35</sup>	Vic	Cross-sectional	Local media, community groups	1995	180, aged 50-69 years, no screening 6-months	Utilization of a screening service	Logistic regression	No previous screening history, higher perceived breast cancer risk, lower education and knowledge of service location predictors of screening. <sup>2</sup>
Leung <i>et al</i> 2014 <sup>36</sup>	National	Longitudinal prospective survey	ALSWH	2001-2010	11,200, aged 50-55 years (2001)	Self-reported screening history, rescreening (within last two years)	Chi-square, Logistic regression	No differences in screening rates. <sup>3</sup> Non-metropolitan women (versus metropolitan) had poorer access to screening services and were 25-63% more likely to be rescreened. <sup>3</sup>
Leung <i>et al</i> 2015 <sup>37</sup>	National	Longitudinal prospective survey	ALSWH	2010	10,011, aged 59-64 years (2010)	Self-reported screening history, rescreening (within last two years)	Chi-square, Logistic regression	No differences in screening rates. <sup>4</sup> Non-metropolitan women (versus metropolitan) were 15% more likely to be rescreened. <sup>4</sup>
Schofield <i>et al</i> 1994 <sup>38</sup>	Vic	Random sampling	Electoral lists (target area)	1988-1990	668, aged 50-69 years	Utilization of a single screening service	Logistic regression	Women who lived within 10-20 km (versus < 2km) of the service 43% less likely to be screened. <sup>5</sup>
Siapush & Singh 2002 <sup>39</sup>	National	Multistage sampling	ANHS	1995	10,179, aged ≥18 years	Self-reported screening history, rescreening (1 year)	Logistic regression	Non-metropolitan women (versus metropolitan) 39% more likely to have no screening history and 20% more likely to not be rescreened. <sup>6</sup>
Sullivan <i>et al</i> 2003 <sup>40</sup>	WA	Record linkage	Disability Services database, WA CR, BS WA	1982-2000	380, aged 50-69 years, known intellectual disability	Utilization of screening service	Logistic regression	Non-metropolitan women (versus metropolitan) 2 times more likely to be screened. <sup>7</sup>
Weber <i>et al</i> 2014 <sup>41</sup>	NSW	Cohort	Medicare Australia	2006-2010	101,063 (76% Australian, 24% immigrant), aged ≥50 years	Self-reported screening history	Poisson regression	Non-metropolitan Australian-born women (versus metropolitan) 2% more likely to be screened. <sup>8</sup> No difference for immigrant women.
Hughes <i>et al</i> 2014 <sup>42</sup>	WA	Retrospective cohort	BS WA	1999-2008	NS, aged 50-67 years, had screening history	Rescreening (within 27 months)	Not stated	No differences in rescreening rates
O'Byrne <i>et al</i> 2000 <sup>43</sup>	Vic	Retrospective cohort	BS Vic	1995-1996	121,889, aged 50-69 years, had screening history	Rescreening (within 27 months)	Logistic regression	Non-metropolitan women (versus metropolitan) women 13-24% more likely to be rescreened. <sup>9</sup>

ALSWH Australian Longitudinal Study on Women's Health, ANHS Australian National Health Survey, BS BreastScreen, CR Cancer Registry

1. National: all states/territories; NSW: New South Wales; Vic: Victoria and WA Western Australia
2. Adjusted for screening history, perceived breast cancer risk, screening awareness and barriers, knowledge of service location, intention to attend and socio-demographics
3. Adjusted for time and interaction between time and residential area.
4. Adjusted for age and area-disadvantage.
5. Adjusted for intention to attend, breast cancer related factors, screening awareness, barriers and concerns, other preventive behaviours and demographics.
6. Adjusted for age, demographics and area-disadvantage.
7. Adjusted for age, demographics and health-status related factors.
8. Adjusted for age, demographics and hormone replacement therapy; stratified by country of birth .
9. Adjusted for age, Indigenous status, demographics, area-disadvantage and clinical factors related to initial screening.

**Table 4.** Characteristics of included studies on treatment outcomes

Study	Location <sup>1</sup>	Design	Source	Period	Sample <sup>2</sup>	Outcomes	Analysis	Key findings
Adelson <i>et al</i> 1997 <sup>44</sup>	NSW	Retrospective record linkage	NSW CCR, ISC	1991-1992	4,038, known spread disease, BC-surgery	BCS versus MST	Chi-square, Logistic regression	Non-metropolitan women (versus metropolitan) 2 times more likely to have MST (localized disease); no difference for metastatic disease. <sup>3</sup>
Ahern <i>et al</i> 2015 <sup>45</sup>	National	Cross-sectional	Two national databases	2013	325, aged at least 18 years, BC diagnosis 6-30 months ago	RT, CT, HT, BR	Chi-square	No differences in receipt of surgery or adjuvant therapies.
Ahern <i>et al</i> 2016 <sup>46</sup>	National	Cross-sectional	Two national databases	2013	902, aged at least 18 years, post active treatment	Interactions with BCN, CT	Chi-square	No differences in receipt of BCN care or CT
Azzopardi <i>et al</i> 2014 <sup>47</sup>	National	Clinical audit	NBCA database <sup>4</sup>	1998-2012	21,643, early disease <sup>5</sup>	BCS versus MST, adjuvant RT	Chi-square (surgery), Logistic regression (RT)	Proportions of BCS decreased and MST increased with increasing remoteness Women from areas lacking a RT facility (versus RT facility present, 23%) and non-metropolitan women (versus metropolitan, 20%) less likely to have RT. <sup>6</sup>
Baade <i>et al</i> 2016 <sup>48</sup>	Qld	Cohort	Qld CR, Qld HAPDC, record linkage	1997-2011	11,631, aged at least 20 years, localised disease <sup>7</sup> , first primary BC, BC-surgery	BCS	Logistic regression	Women from less accessible areas (versus highly accessible) less likely to have BCS. <sup>8</sup> Trend analysis showed some evidence for temporal reduction in disparity, but inequalities remained. Women living in more accessible areas more likely to attend high volume hospitals (≥100 cases per year).
Bell <i>et al</i> 2012 <sup>49</sup>	Vic	Longitudinal cohort,	Health & Wellbeing After BC study	2004-2006	366, prior unilateral MST, known BR status	BR	Logistic Regression	Non-metropolitan women (versus metropolitan) 73% less likely to have BR. <sup>9</sup>
Budden <i>et al</i> 2014 <sup>50</sup>	Qld (3 regional areas)	Cross-sectional	Local surgeons	NS	104, Stage 1-IIA, MST or BCS/RT	Satisfaction treatment decision	Chi-square	90% women satisfied with decision process
Campbell <i>et al</i> 2006 <sup>51</sup>	National (not Tas)	Cross-sectional	State Cancer Registries	1997	544, early disease	Systematic SBN care	Chi-square	No differences in receipt of systematic SBN care
Chong <i>et al</i> 2015 <sup>52</sup>	National	Clinical audit	NBCA database <sup>4</sup>	2008-2010	18,737, early disease <sup>5</sup>	SNB	Logistic Regression	Non-metropolitan women (versus metropolitan) less likely to have SNB. <sup>10</sup>
Collins <i>et al</i> 2017 <sup>53</sup>	Vic (one regional area)	Cohort	ECO Barwon SW CR	2009-2014	1,213, early disease	BCS versus MST	Chi-square, Logistic regression	Women who lived ≥100-200 km (versus <100 km) of a radiotherapy centre were 1.6 times more likely to have MST. <sup>11</sup> No difference for those living more than 200 km away
Craft <i>et al</i> 1997 <sup>54</sup>	National	Retrospective survey	Medicare Australia	1993	4,683, had BC-surgery	BCS, AS	Chi-square	Non-metropolitan women (versus metropolitan) had lower BCS (34% versus 42%); no differences in AS rates
Dasgupta <i>et al</i> 2017b <sup>55</sup>	Qld	Cohort	Qld CR, Qld HAPDC, record linkage	1 <sup>st</sup> July 2008-31 <sup>st</sup> December 2012	5,577, aged at least 20 years, early disease <sup>12</sup> , first primary BC, prior BCS or MST	SNB versus AS	Logistic regression	Women from less accessible areas (versus highly accessible) 39-58% less likely to have SNB. <sup>13</sup> Trend analysis showed no evidence for temporal eduction in geographical disparities.

Study	Location <sup>1</sup>	Design	Source	Period	Sample <sup>2</sup>	Outcomes	Analysis	Key findings
Dasgupta <i>et al</i> 2017c <sup>56</sup>	Qld	Cohort	Qld CR, Qld HAPDC, record linkage	1997-2012	4,104, aged at least 20 years, localised disease <sup>7</sup> , first primary BC, prior MST	BR	Logistic regression	Women from less accessible areas (versus highly accessible) 27-74% less likely to have post-mastectomy BR. <sup>14</sup> Trend analysis showed that the geographical disparity had reduced over time.
Eley <i>et al</i> 2008 <sup>57</sup>	Qld (one region)	Cross-sectional	Local BCN	2005-2006	51, aged 38-79 years, post active treatment	Interactions with BCN	Frequencies	BCN valuable source of treatment-related information (86% sampled women) and help during decision-process (71%).
Flitcroft <i>et al</i> 2016 <sup>58</sup>	National	Clinical audit	NBCA database <sup>4</sup>	2013	3,786, aged at least 20 years, early disease <sup>5</sup> , prior MST	BR	Chi-square	Non-metropolitan women (versus metropolitan) less likely to have BR
Fox <i>et al</i> 2013 <sup>28</sup>	NSW	Medical chart reviews	4 medical centres	2008-2011	400, non-metastatic, had adjuvant CT	Delays, CT finish	Chi-square, Mann-Whitney	Non-metropolitan women (versus metropolitan) more likely to have longer delays in consultation and starting CT and to complete CT course (90% versus 82%).
Hall & Holman 2003 <sup>59</sup>	WA	Cohort	WA Record Linkage Project	1991-2000	7,303, prior MST or BCS	BR (yes/no)	Chi-square, Cox regression	No differences in BR rates. <sup>15</sup>
Hall <i>et al</i> 2004b <sup>60</sup>	WA	Cohort	WA Record Linkage Project	1991-2000	7,304, BC-surgery	BCS versus MST	Chi-square, Logistic regression	No differences in surgical patterns. <sup>16</sup>
Hsieh <i>et al</i> 2015 <sup>61</sup>	Qld	Cohort	Qld CR, BS Qld, record linkage	1997-2008	6,357 aged 40-89, screen-detected BC	adjuvant RT, CT, HT	Bayesian shared spatial component model	Women living >4 or more hours from a radiation facility were 59% less likely to have adjuvant RT. <sup>17</sup> No differences for CT or HT
Hill <i>et al</i> 1994 <sup>62</sup>	Vic	Population-based survey	Vic CR	1990	856, BC-surgery	BCS, adjuvant RT, CT, HT, Referral	Chi-square, ANOVA, Student t-test	Non-metropolitan women (versus metropolitan) less likely to have BCS (33% versus 46%); no differences in adjuvant therapies (no quantitative data) or medical oncologist referrals. Non-metropolitan surgeons less likely to refer patients to radiation oncologists (28% versus 43%).
Kok <i>et al</i> 2006 <sup>29</sup>	Vic	Retrospective cohort	BS Vic	1993-2000	5,294 screen-detected	BCS versus MST, adjuvant RT	Chi-square, Logistic regression	Non-metropolitan women (versus metropolitan) 58% less likely to have BCS and 27% less likely to have post-BCS RT. <sup>18</sup>
Koshy <i>et al</i> 2005 <sup>63</sup>	NSW, ACT	Prospective audit	Pathology reports, medical charts, clinicians	1997-2002	1,069, non-metastatic, BC-surgery	BCS versus MST	Chi-square	No differences in surgical patterns.
Kricker <i>et al</i> 2001 <sup>64</sup>	NSW	Cohort	NSW CCR, ISC record linkage	1992, 1995	2,020 or 2,883, BC-surgery	BCS versus MST, AS	Logistic regression	No differences in surgical patterns or AS rates. <sup>19</sup>
Lai <i>et al</i> 2007 <sup>65</sup>	WA	Cohort/	WA Record Linkage Project	1995-1999	2,703, BC-surgery	Unplanned hospital readmission	Survival model	Metropolitan women (versus non-metropolitan) 10% lower unplanned readmission (within 42 days of initial surgery) rates. <sup>18</sup>

Study	Location <sup>1</sup>	Design	Source	Period	Sample <sup>2</sup>	Outcomes	Analysis	Key findings
Lam <i>et al</i> 2015 <sup>66</sup>	NSW (one region)	Cross-sectional	Local surgeons and nurses	2010-2014	574, early disease <sup>5</sup> , BC-surgery	BCS	Chi-square	BC rates increased by 9% when local publicly funded radiotherapy became available in 2013 compared to earlier years when only options were local private or publicly funded out-of-area services.
Martin <i>et al</i> 2006 <sup>67</sup>	WA	Cohort/	WA Record Linkage Project	1990-1999	2,713, first primary BC, BC-surgery	BCS versus MST	Logistic regression	Non-metropolitan women (versus metropolitan) more likely to have MST. <sup>20</sup>
Mastaglia & Kristjanson 2001 <sup>68</sup>	WA	Cross-sectional	WA CR	1996-1997	160, Stage I-II, BC-surgery	BCS versus MRM	Chi-square	Non-metropolitan women more likely to have MRM than BCS (71% versus 36% metropolitan).
Mitchell <i>et al</i> 2006 <sup>14</sup>	WA	Cohort	WA CR	1999	899 (692 HR+) histologically verified	BCS, adjuvant RT, CT, HT, High (>=20 cases/year) caseload surgeon	Chi-square	Non-metropolitan women (versus metropolitan) less likely to have BCS (42% versus 59%), RT (43% versus 55%), HT (64% versus 70%, if HR +, 75% versus 85%), or high caseload surgical care (70% versus 86%); no difference in CT.
Morris <i>et al</i> 2012 <sup>69</sup>	National	Audit	NBCA, NSW CCR, Vic CR, MBS	2008 (last 6 months)	1,334 (NBCA), 1,359 (NSW), 1,267 (Vic), <=30mm size	SNB	z-tests (pooled)	Non-metropolitan women less likely to have SNB (NCBA 66% versus 82% metropolitan; NSW 76% versus 86%; Vic 65% versus 81%).
Ristevski <i>et al</i> 2012 <sup>70</sup>	Vic (one regional area)	Cross-sectional	Local surgeons and nurses	NS	70, first primary BC, early disease <sup>5</sup> , >=six weeks post-surgery	Satisfaction, Referral	Descriptive, Fischer's exact test	97% of sample satisfied with treatment decision process regardless of surgical procedure. 42% referred to other health professionals/service before surgery.
Roder <i>et al</i> 2013a <sup>23</sup>	National	Non-representative sample	NBCA database <sup>4</sup>	1998-2010	30,299, early disease <sup>5</sup> ,	BCS versus MST, adjuvant RT, CT, Low (<=10 cases/year) caseload surgeon	Chi-square, Logistic regression	Non-metropolitan women (versus metropolitan) less likely to have BCS (6%) or RT after BCS (7%) but more likely to have CT (10%), care at regional (4-31% versus major city) or remote centres (7 times) and low caseload care (9%). <sup>21</sup>
Roder <i>et al</i> 2013b <sup>33</sup>	National	Non-representative sample	NBCA database <sup>4</sup>	1998-2010	30,299, early disease <sup>5</sup>	BCS versus MST, Low (<=10 cases/year) caseload surgeon	Chi-square, Logistic regression	Non-metropolitan women (versus metropolitan) more likely to have MST (5-9 times, adjusted <sup>22</sup> ) Low surgical caseload predictor of treatment outside major cities and higher MST.)
Roder <i>et al</i> 2013c <sup>71</sup>	National	Non-representative sample	NBCA database <sup>4</sup>	1998-2010	12,207, early disease <sup>5</sup> , prior MST,	IBR versus delayed or no BR	Chi-square, Logistic regression	Non-metropolitan women (versus metropolitan) 13% less likely to have IBR Metropolitan rather than inner regional treatment centre and high (>=11 cases/year) surgical caseload predictors of IBR. <sup>23</sup>
Roder <i>et al</i> 2012b <sup>72</sup>	National	Non-representative sample	NBCA database <sup>4</sup>	1998-2005	36,775, early disease <sup>5</sup>	Declining recommended treatment	Chi-square, Logistic regression	Women treated at non-metropolitan centres and low surgical caseload (<=20 cases/year) were more likely to decline BCS, RT, MST, AS or CT (caseload only.); HT (location only). <sup>24</sup>
Thompson <i>et al</i> 2008 <sup>73</sup>	Qld	Cohort	Qld CR, Qld HAPDC, record linkage	2004	1,274, early disease <sup>5</sup>	MST, AS	Chi-square, Logistic regression	Non-metropolitan women (versus metropolitan) 2 times more likely to have MST, no differences in AS rates. <sup>25</sup>

Study	Location <sup>1</sup>	Design	Source	Period	Sample <sup>2</sup>	Outcomes	Analysis	Key findings
Tulloh & Goldsworthy 1997 <sup>74</sup>	Vic	Medical chart reviews	Single rural centre	1992-1995	28	BCS versus MST	Descriptive	Rural setting no impediment to BCS (68%) or a multidisciplinary approach (93%).

AS axillary surgery (lymph nodes), BC Breast Cancer, BCN breast cancer nurse, BCS breast conservation surgery, BR breast reconstruction, BS BreastScreen, CR Cancer Registry, CCR Central Cancer Registry, CT chemotherapy, HAPDC Hospital Admitted Patient Data Collection, HR hormone receptor, HT hormone therapy, IBR immediate breast reconstruction, ISC Inpatient Statistics Collection, MRM modified radical mastectomy, MST mastectomy, NBCA National Breast Cancer Audit (also called BQA, Breast Surgeons ANZ Quality Audit), SBN specialist breast nurse, SE South-East, SNB sentinel node biopsy, RT adjuvant radiotherapy

1. National: all states/territories; ACT: Australian Capital Territory; NSW: New South Wales; Qld: Queensland; SA: South Australia; Vic: Victoria and WA Western Australia
2. Female invasive breast cancers cases
3. Adjusted for age at diagnosis, spread of disease, interaction between degree of spread and residential location.
4. National Breast Cancer Audit Database covers about 60% of early invasive female breast cancers diagnosed in Australia between 1998 and 2010.
5. Early disease defined as invasive tumours of  $\leq 50\text{mm}$  size with either impalpable or palpable but not fixed lymph nodes and no evidence for distant metastases.
6. Adjusted for presence/absence of a radiotherapy facility in the same postcode as residential location of patient.
7. Localised disease defined as invasive tumours of  $\leq 20\text{mm}$  size with no evidence of nodal involvement or metastases.
8. Adjusted for age and year at diagnosis, Indigenous status, demographics, clinical features, comorbidities, area-disadvantage, hospital type and surgical caseload.
9. Adjusted for age at diagnosis, demographics and radiotherapy.
10. Adjusted for age at diagnosis, health insurance status and surgical caseload.
11. Adjusted for age at diagnosis, tumour size and area disadvantage
12. Early disease defined as invasive tumours of  $\leq 50\text{mm}$  size with no evidence of nodal involvement or metastases.
13. Adjusted for age and year at diagnosis, tumour size, initial surgical procedure, area-disadvantage, hospital type and surgical caseload.
14. Adjusted for age and year of diagnosis, Indigenous status, tumour size, area-disadvantage, hospital type and surgical caseload.
15. Adjusted for age at diagnosis, diagnostic period, Indigenous status, demographics, comorbidities, area-disadvantage and hospital related factors.
16. Adjusted for age at diagnosis, Indigenous status, demographics, clinical features, first screen diagnosis and area-disadvantage.
17. Adjusted for age at diagnosis, diagnostic period, demographics, clinical features, area-disadvantage, symptom status, cancer history and surgical caseload
18. Adjusted for age at diagnosis, area-disadvantage and country of birth.
19. Adjusted for age at diagnosis, clinical features, initial surgical procedure, health insurance status, country of birth and interactions between these variables.
20. Adjusted for age at diagnosis, clinical features, Indigenous status and demographics.
21. Adjusted for diagnostic period, area disadvantage and hospital location.
22. Adjusted for tumour size
23. Adjusted for age and year at diagnosis, clinical features, area-disadvantage, referral source, health insurance status, surgical caseload and treatment-related factors.
24. Adjusted for age at diagnosis, clinical features, hospital location, health insurance status and surgical caseload
25. Adjusted for age at diagnosis, tumour size, comorbidities, hospital type and surgical caseload.



References

1. AIHW. Cancer survival and prevalence in Australia: Period estimates from 1982 to 2010. *Asia Pac J Clin Oncol* 2013;9(1):29-39.

2. Bonett A, Dorsch M, Roder D, et al. Infiltrating ductal carcinoma of the breast in South Australia. Implications of trends in tumour diameter, nodal status and case-survival rates for cancer control. *Med J Aust* 1990;152(1):19-23.

3. Chen TY, Morrell S, Thomson W, et al. Survival from breast, colon, lung, ovarian and rectal cancer by geographical remoteness in New South Wales, Australia, 2000-2008. *Aust J Rural Health* 2015;23(1):49-56.

4. Clayforth C, Fritschi L, McEvoy SP, et al. Five-year survival from breast cancer in Western Australia over a decade. *Breast* 2007;16(4):375-81.

5. Cramb SM, Mengersen KL, Turrell G, et al. Spatial inequalities in colorectal and breast cancer survival: premature deaths and associated factors. *Health Place* 2012;18(6):1412-21.

6. Cramb SM, Mengersen KL, Lambert PC, et al. A flexible parametric approach to examining spatial variation in relative survival. *Stat Med* 2016;35(29):5448-63.

7. Cramb SM, Mengersen KL, Baade PD. Spatio-temporal relative survival of breast and colorectal cancer in Queensland, Australia 2001-2011. *Spat Spatiotemporal Epidemiol* 2016;19:103-14.

8. Cramb SM, Moraga P, Mengersen KL, et al. Spatial variation in cancer incidence and survival over time across Queensland, Australia. *Spat Spatiotemporal Epidemiol* 2017;23:59-67.

9. Dasgupta P, Baade PD, Aitken JF, et al. Multilevel determinants of breast cancer survival: association with geographic remoteness and area-level socioeconomic disadvantage. *Breast Cancer Res Treat* 2012;132(2):701-10.

10. Hall S, Holman CD, Sheiner H, et al. The influence of socio-economic and locational disadvantage on survival after a diagnosis of lung or breast cancer in Western Australia. *J Health Serv Res Policy* 2004;9 Suppl 2:10-6.

11. Hsieh JC-F, Cramb SM, McGree JM, et al. Bayesian Spatial Analysis for the Evaluation of Breast Cancer Detection Methods. *Australian & New Zealand Journal of Statistics* 2014;55(4):351-67.

12. Hsieh JC, Cramb SM, McGree JM, et al. Spatially Varying Coefficient Inequalities: Evaluating How the Impact of Patient Characteristics on Breast Cancer Survival Varies by Location. *PLoS One* 2016;11(5):e0155086.

13. Hsieh JCF, Cramb SM, McGree JM, et al. Does geographic location impact the survival differential between screen- and interval-detected breast cancers? *Stoch Environ Res Risk Assess* 2016;30(1):155-65.

14. Mitchell KJ, Fritschi L, Reid A, et al. Rural-urban differences in the presentation, management and survival of breast cancer in Western Australia. *Breast* 2006;15(6):769-76.

15. Roder D, Webster F, Zorbas H, et al. Breast screening and breast cancer survival in Aboriginal and Torres Strait Islander women of Australia. *Asian Pacific journal of cancer prevention : APJCP* 2012;13(1):147-55.

16. Spilsbury K, Semmens JB, Saunders CM, et al. Long-term survival outcomes following breast cancer surgery in Western Australia. *ANZ J Surg* 2005;75(8):625-30.

17. Supramaniam R, Gibberd A, Dillon A, et al. Increasing rates of surgical treatment and preventing comorbidities may increase breast cancer survival for Aboriginal women. *BMC Cancer* 2014;14(1).



18. Taylor R. Breast cancer five-year survival, by New South Wales regions, 1980 to 1991. *Aust N Z J Public Health* 1997;21(2):206-10.
19. Tervonen HE, Aranda S, Roder D, et al. Cancer survival disparities worsening by socio-economic disadvantage over the last 3 decades in new South Wales, Australia. *BMC Public Health* 2017;17(1):691.
20. Tracey E, Roder D, Zorbas H, et al. Survival and degree of spread for female breast cancers in New South Wales from 1980 to 2003: implications for cancer control. *Cancer Causes Control* 2008;19(10):1121-30.
21. Yu XQ, Luo Q, Kahn C, et al. Temporal trends show improved breast cancer survival in Australia but widening urban-rural differences. *Breast* 2015;24(4):524-7.
22. Wilkinson D, Cameron K. Cancer and cancer risk in South Australia: what evidence for a rural-urban health differential? *Aust J Rural Health* 2004;12(2):61-66.
23. Roder D, Zorbas H, Kollias J, et al. Risk factors for poorer breast cancer outcomes in residents of remote areas of Australia. *Asian Pac J Cancer Prev* 2013;14(1):547-52.
24. Roder D, Zorbas HM, Kollias J, et al. Analysing risk factors for poorer breast cancer outcomes in residents of lower socioeconomic areas of Australia. *Aust Health Rev* 2014;38(2):134-41.
25. Baade PD, Turrell G, Aitken JF. Geographic remoteness, area-level socio-economic disadvantage and advanced breast cancer: a cross-sectional, multilevel study. *J Epidemiol Community Health* 2011;65(11):1037-43.
26. Dasgupta P, Youl PH, Aitken JF, et al. Geographical differences in risk of advanced breast cancer: Limited evidence for reductions over time, Queensland, Australia 1997-2014. *Breast* 2017;36:60-66.
27. Depczynski J, Dobbins T, Armstrong B, et al. Stage of diagnosis of prostate, breast and colorectal cancer in farm residents compared with other rural and urban residents in New South Wales. *Aust J Rural Health* 2017.
28. Fox PN, Chatfield MD, Beith JM, et al. Factors delaying chemotherapy for breast cancer in four urban and rural oncology units. *ANZ J Surg* 2013;83(7-8):533-8.
29. Kok DL, Chang JH, Erbas B, et al. Urban-rural differences in the management of screen-detected invasive breast cancer and ductal carcinoma in situ in victoria. *ANZ J Surg* 2006;76(11):996-1001.
30. Leung J, Martin J, McLaughlin D. Rural-urban disparities in stage of breast cancer at diagnosis in Australian women. *Aust J Rural Health* 2016;24(5):326-32.
31. Luke C, Nguyen AM, Priest K, et al. Female breast cancers are getting smaller, but socio-demographic differences remain. *Aust N Z J Public Health* 2004;28(4):312-6.
32. Lord SJ, Marinovich ML, Patterson JA, et al. Incidence of metastatic breast cancer in an Australian population-based cohort of women with non-metastatic breast cancer at diagnosis. *Med J Aust* 2012;196(11):688-92.
33. Roder D, Zorbas H, Kollias J, et al. Factors predictive of treatment by Australian breast surgeons of invasive female breast cancer by mastectomy rather than breast conserving surgery. *Asian Pac J Cancer Prev* 2013;14(1):539-45.
34. Barratt AL, Cockburn J, Redman S, et al. Mammographic screening: results from the 1996 National Breast Health Survey. *Med J Aust* 1997;167(10):521-4.
35. Cockburn J, Sutherland M, Cappiello M, et al. Predictors of attendance at a relocatable mammography service for rural women. *Aust N Z J Public Health* 1997;21(7):739-42.

36. Leung J, McKenzie S, Martin J, et al. Longitudinal patterns of breast cancer screening: mammography, clinical, and breast self-examinations in a rural and urban setting. *Womens Health Issues* 2014;24(1):e139-46.

37. Leung J, Macleod C, McLaughlin D, et al. Screening mammography uptake within Australia and Scotland in rural and urban populations. *Prev Med Rep* 2015;2:559-62.

38. Schofield PE, Cockburn J, Hill DJ, et al. Encouraging attendance at a screening mammography programme: determinants of response to different recruitment strategies. *J Med Screen* 1994;1(3):144-9.

39. Siahpush M, Singh GK. Sociodemographic variations in breast cancer screening behavior among Australian women: results from the 1995 National Health Survey. *Prev Med* 2002;35(2):174-80.

40. Sullivan SG, Glasson EJ, Hussain R, et al. Breast cancer and the uptake of mammography screening services by women with intellectual disabilities. *Prev Med* 2003;37(5):507-12.

41. Weber MF, Chiew M, Feletto E, et al. Cancer screening among immigrants living in urban and regional Australia: Results from the 45 and up study. *Int J Environ Res Public Health* 2014;11(8):8251-66.

42. Hughes JP, Jose DC, Tuch GH, et al. Is Step Down Assessment of screen-detected lesions as safe as workup at a Metropolitan Assessment Centre? *Aust N Z J Public Health* 2014;38(1):44-48.

43. O'Byrne AM, Kavanagh AM, Ugoni A, et al. Predictors of non-attendance for second round mammography in an Australian mammographic screening programme. *J Med Screen* 2000;7(4):190-4.

44. Adelson P, Lim K, Churches T, et al. Surgical treatment of breast cancer in New South Wales 1991, 1992. *Aust N Z J Surg* 1997;67(1):9-14.

45. Ahern T, Gardner A, Courtney M. Geographical comparisons of information and support needs of Australian women following the primary treatment of breast cancer: a 10-year replication study. *Health Expect* 2015;18(6):2678-92.

46. Ahern T, Gardner A, Courtney M. Exploring patient support by breast care nurses and geographical residence as moderators of the unmet needs and self-efficacy of Australian women with breast cancer: Results from a cross-sectional, nationwide survey. *Eur J Oncol Nurs* 2016;23:72-80.

47. Azzopardi J, Walsh D, Chong C, et al. Impact of geographic location on surgical outcomes of women with breast cancer. *ANZ J Surg* 2014;84(10):735-39.

48. Baade PD, Dasgupta P, Youl PH, et al. Geographical Inequalities in Surgical Treatment for Localized Female Breast Cancer, Queensland, Australia 1997-2011: Improvements over Time but Inequalities Remain. *Int J Environ Res Public Health* 2016;13(7).

49. Bell RJ, Robinson PJ, Fradkin P, et al. Breast reconstruction following mastectomy for invasive breast cancer is strongly influenced by demographic factors in women in Victoria, Australia. *Breast* 2012;21(3):394-400.

50. Budden LM, Hayes BA, Buettner PG. Women's decision satisfaction and psychological distress following early breast cancer treatment: a treatment decision support role for nurses. *Int J Nurs Pract* 2014;20(1):8-16.

51. Campbell D, Khan A, Rankin N, et al. Are specialist breast nurses available to Australian women with breast cancer? *Cancer Nurs* 2006;29(1):43-8.

52. Chong C, Walters D, de Silva P, et al. Initial axillary surgery: results from the BreastSurgANZ Quality Audit. *ANZ J Surg* 2015;85(10):777-82.

53. Collins IM, Lum C, Versace VL. Influence of socioeconomic factors and distance to radiotherapy on breast-conserving surgery rates for early breast cancer in regional Australia; implications of change. *Asia Pac J Clin Oncol* 2017;10.1111/ajco.12828:n/a-n/a.
54. Craft PS, Primrose JG, Lindner JA, et al. Surgical management of breast cancer in Australian women in 1993: analysis of Medicare statistics. *Med J Aust* 1997;166(12):626-9.
55. Dasgupta P, Youl PH, Pyke C, et al. Sentinel node biopsy for early breast cancer in Queensland, Australia, during 2008-2012. *ANZ J Surg* 2017;10.1111/ans.14047.
56. Dasgupta P, Youl PH, Pyke C, et al. Geographical disparity in breast reconstruction following mastectomy has reduced over time. *ANZ J Surg* 2017;87(11):E183-E87.
57. Eley RM, Rogers-Clark C, Murray K. The value of a breast care nurse in supporting rural and remote cancer patients in Queensland. *Cancer Nurs* 2008;31(6):E10-8.
58. Flitcroft K, Brennan M, Costa D, et al. Documenting patterns of breast reconstruction in Australia: The national picture. *Breast* 2016;30:47-53.
59. Hall SE, Holman CD. Inequalities in breast cancer reconstructive surgery according to social and locational status in Western Australia. *Eur J Surg Oncol* 2003;29(6):519-25.
60. Hall SE, Holman CD, Hendrie DV, et al. Unequal access to breast-conserving surgery in Western Australia 1982-2000. *ANZ J Surg* 2004;74(6):413-9.
61. Hsieh JC, Cramb SM, McGree JM, et al. Geographic variation in the intended choice of adjuvant treatments for women diagnosed with screen-detected breast cancer in Queensland. *BMC Public Health* 2015;15:1204.
62. Hill DJ, White VM, Giles GG, et al. Changes in the investigation and management of primary operable breast cancer in Victoria. *Med J Aust* 1994;161(2):110-18.
63. Koshy A, Buckingham JM, Zhang Y, et al. Surgical management of invasive breast cancer: a 5-year prospective study of treatment in the Australian Capital Territory and South-Eastern New South Wales. *ANZ J Surg* 2005;75(9):757-61.
64. Kricker A, Haskill J, Armstrong BK. Breast conservation, mastectomy and axillary surgery in New South Wales women in 1992 and 1995. *Br J Cancer* 2001;85(5):668-73.
65. Lai JK, Martin MA, Meyricke R, et al. Factors associated with short-term hospital readmission rates for breast cancer patients in Western Australia: an observational study. *J Am Coll Surg* 2007;204(2):193-200.
66. Lam J, Cook T, Foster S, et al. Examining Determinants of Radiotherapy Access: Do Cost and Radiotherapy Inconvenience Affect Uptake of Breast-conserving Treatment for Early Breast Cancer? *Clin Oncol (R Coll Radiol)* 2015;27(8):465-71.
67. Martin MA, Meyricke R, O'Neill T, et al. Mastectomy or breast conserving surgery? Factors affecting type of surgical treatment for breast cancer - A classification tree approach. *BMC Cancer* 2006;6.
68. Mastaglia B, Kristjanson LJ. Factors influencing women's decisions for choice of surgery for Stage I and Stage II breast cancer in Western Australia. *J Adv Nurs* 2001;35(6):836-47.
69. Morris T, Wetzig N, Sinclair S, et al. Evaluation of implementation of sentinel node biopsy in Australia. *ANZ J Surg* 2012;82(7-8):541-7.
70. Ristevski E, Regan M, Birks D, et al. Communicating about breast cancer: rural women's experience of interacting with their surgeon. *Aust J Rural Health* 2012;20(1):22-8.
71. Roder D, Zorbas H, Kollias J, et al. Factors predictive of immediate breast reconstruction following mastectomy for invasive breast cancer in Australia. *Breast* 2013;22(6):1220-5.

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

72. Roder DM, de Silva P, Zorbas HN, et al. Adherence to recommended treatments for early invasive breast cancer: decisions of women attending surgeons in the breast cancer audit of Australia and New Zealand. *Asian Pac J Cancer Prev* 2012;13(4):1675-82.

73. Thompson B, Baade P, Coory M, et al. Patterns of surgical treatment for women diagnosed with early breast cancer in Queensland. *Ann Surg Oncol* 2008;15(2):443-51.

74. Tulloh BR, Goldsworthy ME. Breast cancer management: a rural perspective. *Med J Aust* 1997;166(1):26-9.

For peer review only



# PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
<b>TITLE</b>			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
<b>ABSTRACT</b>			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
<b>INTRODUCTION</b>			
Rationale	3	Describe the rationale for the review in the context of what is already known.	4
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	5, Table 1
<b>METHODS</b>			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	NR
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	5-6
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	5
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Supplementary file 1
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	5-6
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	7
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	NR
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	6
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	NR
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., $I^2$ ) for each meta-analysis.	7



# PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	6
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	NR
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	7, Figure 1
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	Tables 2-6 (Pages 20-26)
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	7-8, Tables 2-6 (Pages 20-26)
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	8-12, Tables 2-6 (Pages 20-26)
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	NR
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	NR
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	NR
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	12-14
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	15
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	15-16
FUNDING			



# PRISMA 2009 Checklist

Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	17
---------	----	--	----

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit: [www.prisma-statement.org](http://www.prisma-statement.org).

Page 2 of 2

For peer review only